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Railway
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February - 1931

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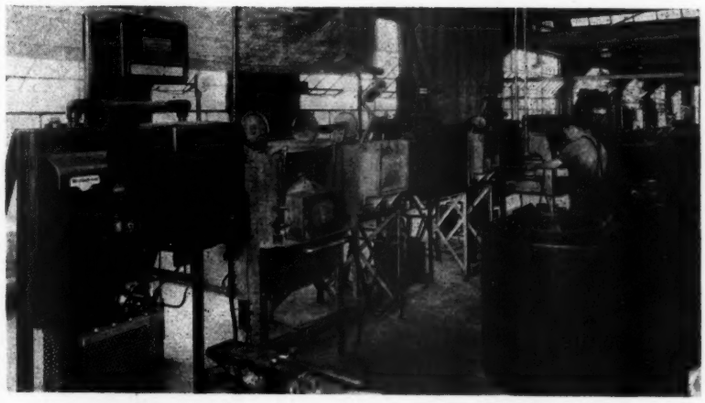
Industrial Electric Heating For Railway Shops*

By Wirt S. Scott†

A study of electrical heating equipment in use in the Norfolk & Western shops at Roanoke, Va., with costs of operation and savings effected by its use



Heat-treating department for small tools

ALTHOUGH the use of electricity for heat treating has extended to many industries, comparatively little was known until recently of the steam-railway industry's attitude towards the use of electric heat for this purpose. For this reason it was decided to make a study of the economic value of electrical-heating equipment in the Norfolk & Western Shops at Roanoke, Va., these shops being selected for such an analysis because electricity is widely used there for heating purposes.

Equipment of many different manufacturers is represented at the Roanoke Shops. Irrespective of the kind, type or make of the equipment used, an attempt was made to determine in a concrete manner the advantage of such equipment in comparison to past practice. All of the equipment was found to be giving a good account of itself and the repairs to it have been negligible. The following table contains a list of the equipment which was studied to obtain comparative cost data.

The Roanoke shops are not completely electrified, the Norfolk & Western's problem being similar to that of other companies, i.e., financing the expenditure. From the study of the equipment installed, however, it has been determined that electric heating is economical, ac-

Electrical Heating Equipment Used in the Norfolk & Western Shops at Roanoke, Va.

Babbitting department	102 kw.
1—50-kw. melting pot for melting down old bearings	
1—30-kw. tinning pot for brasses	
1—22-kw. babbit melting pot	
Electrical department	30 kw.
1—30-kw. armature baking oven	
Tool department	51 kw.
1—8-kw. preheating and tempering furnace.	
1—13-kw. hardening furnace, carbon steel	
1—30-kw. hardening furnace, high-speed steel	
Forge department	240 kw.
2—120-kw. carburizing furnaces	
Core-making department	555 kw.
3—185-kw. core-baking ovens	
Foundry	540 kw.
1—540-kw. annealing furnace	
Additional Equipment	
1—Steel melting furnace	1,000 kw.
1—Rivet heater	30 kw
Miscellaneous glue pots	5 kw.
Crane cab heaters	10 kw.
Total Connected Load	2,563 kw.

* This article will appear in two parts. The concluding part will appear in the March issue.

† The author is Special Representative of the Westinghouse Electric & Manufacturing Company.

One of the 120-kw. carburizing furnaces — Approximately 1,500 lb. of carburized parts are obtained per charge with an average production of 2 lb. per kw.-hr. at a cost of $0.004 per lb.

curate, dependable, and that the following advantages are obtained:

1—Uniformity of heating
2—Ease of control
3—Continuity of operation
4—Quality of product
5—Speed of production
6—Maintenance
7—Confidence in the heating process.
8—Removal of uncertainty in the manufacturing process
9—A dependable and uniform-quality product
10—Greatly improved working conditions

Tool Heat-Treating Department

In this department are heat treated the high-speed and carbon-steel tools such as are used in many large machine shops where a wide variety of work is being done, particularly on heavy parts. The furnace equipment includes a preheating furnace for high-speed steel; a hardening furnace for carbon steel which is also used for preheating high-speed steel at temperatures between 1,400 and 1,650 deg. F., and for tempering alloy steel, and a furnace for hardening high-speed steel at 2,250 deg. F. The preheating furnace is also used as a tempering furnace. The size, capacity and range of these furnaces are as follows:

PREHEATING FURNACE
Hearth area: 12 in. by 22 in. by 8 in. high
Electrical capacity: 8 kw., 1 phase, 110 volts
Range of operation: 400 deg. F. to 1,850 deg. F.

HARDENING CARBON STEEL
Hearth area: 12 in. by 28 in. by 8 in. high
Electrical capacity: 13 kw., 1 phase, 220 volts
Range of operation; 1,000 deg. F. to 1,850 deg. F.

HARDENING HIGH-SPEED STEEL
Hearth area: 10 in. by 18 in. by 6 in. high
Electrical capacity: 30 kw. 220 volts
Range of operation: 2,000 deg. F. to 2,500 deg. F.

The operation of heat treating high-speed steel blanks ¼-in. by 1-in. by 6-in. consists of placing them in the 8-kw. furnace at a temperature of 1,000 deg. F., and soaking them for one hour; removing and placing the blanks in the 13-kw. furnace at a temperature of 1,600 deg. F., and soaking them for one-half hour; removing and placing them in the 30-kw. high-speed-steel hardening furnace at a temperature of 2,250 deg. F., for 5 min. The furnaces in this manner are operated at the maximum production capacity, the highest efficiency, and the greatest refinement of the steel and the elimination of heating strains are effected.

Chrome-steel die blocks are hardened at 1,600 deg. F., quenched in oil, tempered at 950 deg. F., and cooled in air. Shear blades are hardened at 1,450 deg. F., quenched in water, and tempered at 420 deg. F. Insert blades for reamers are hardened at 2,250 deg. F., quenched in oil, and tempered at 1,050 deg. F., and cooled in air.

The heat treater in charge of these furnaces reports that since the adoption of electric heat, all guesswork has been eliminated. Experience has taught him that the heating characteristics of the electric furnaces are such that they become definite, with the result that, for each piece heat-treated, a definite time can be allowed for complete saturation. This procedure, supplemented by uniformity of chamber temperature and automatic temperature control, has completely revolutionized methods of operation and results. It is no longer necessary to watch the work, and to attempt to judge by its color if and when properly heated.

The exactness of heat treatment has been reflected in the increased life of the tools, a natural consequence. Since all the tools pass through the tool-grinding department, an investigation was undertaken to determine the tangible results of electric heat treatment. A record was secured in connection with high-speed steel tools, showing that the tool cost has decreased 25 per cent, and that the life has increased one-third. There are 11 men in the grinding department as follows: three men on new work exclusively, two men grinding milling cutters, and five men who spend 75 per cent of their time on old tools and the balance on new tools. The present hourly cost for refinishing tools is $4.21, based on two men at 80c per hr. or $1.60, and 75 per cent of five men's time, or $2.61. One-third of $4.21, or $1.40 is thus saved per hour in labor, or $291.20 per month.

The records also show that at present an average of 1,400 lb. of tool steel are worked up per month, at a cost of 60 cents a pound, or a total purchase price of $840. With the tools lasting one-third longer, since using electric heat, the saving based upon present operating conditions is $280 per month. The total saving is therefore $571.20 per month.

A rough estimate was made as to the monthly power consumption of the three electric furnaces, based upon

The 540-kw. car-type furnace for normalizing steel castings — It operates from four to five nights a week with a consumption of from 400 to 500 kw.-hr. per ton of castings

observed operating conditions over a period of four days. Such computation showed an estimated monthly consumption of 6,250 kw.-hr. which would cost, at an 8-mill rate, exactly $50 a month.

The investigation was extended to the machine shop for the purpose of determining whether or not the machinists have observed any difference in the life of tools. The older and more experienced men reported increased life anywhere from 30 per cent to 50 per cent. In turning steel axles, for instance, the workmen report that they are now getting a 4-ft. cut compared with a 3-ft. cut which was considered a very high average in the past.

Carburizing Furnaces

In the maintenance of locomotives, there are a large number of parts to be carburized, such as wrist pins and bushings, equalizer bushings, split side-rod bushings, brake pins, spring-rigging pins, knuckle pins, die blocks and die-block pins. All of these parts are placed in nickel-chromium carburizing boxes, and packed with crushed bone.

The parts are made of low-carbon steel so as to give maximum toughness, and then given a high-carbon case, 3/64-in. thick for maximum surface wear. The heat treating is done at a temperature of 1,650 deg. F. Two electric furnaces are available, each having a rating of 120 kw. capacity, with an effective hearth area 42 in. wide, 56 in. long and 20 in. high.

These furnaces are of the roller-hearth type, with the rollers extending about 6 ft. outside the furnace, so the boxes may be packed in position and rolled into the furnace. This operation requires the services of two men. Two different size boxes are used, one 16 in. by 22 in. by 18 in. high and another 16 in. by 50 in. by 18 in. high. Two large boxes, or four small boxes, or one large and two small boxes constitutes one charge.

The furnace is charged every afternoon at 5 p. m. Usually from 12 to 16 hours are required per heat, depending upon the weight of charge. An average charge will weigh from 1,400 to 1,500 lb. net of material to be carburized, 1,100 to 1,200 lb. of carburizing boxes, and approximately 500 lb. of crushed bone.

A test was made on one of the furnaces to determine the heating characteristics and power consumption. The furnace was charged with 980 pieces of work totaling 1,436 lb.; carburizing boxes, weighing 1,148 lb, and crushed bone, weighing 505 lb., a total gross weight of 3,089 lb. Other data and results of this test are as follows:

Furnace temperature at start	860 deg. F.
Operating temperature	1,650 deg. F.
Time in	5 P.M.
Time out	6:10 A.M.
Time for furnace thermocouples to reach 1,650 deg. F.	2 hr. 45 min.
Time furnace is held at 1,650 deg. F.	10 hr. 25 min.
Total time	13 hr. 10 min.
Kw.-hr. consumed in reaching 1,650 deg. F.	328
Kw.-hr. consumed after reaching 1,650 deg. F.	400
Total kw.-hr. consumed	728
Gross pounds of material per kw.-hr.	4.25
Net pounds of work carburized per kw-hr.	1.97
Cost of power per charge, at 0.8 cent per kw.-hr.	$5.828
Net cost of power per pound of material carburized	$0.00406

Tests made on carburized parts show a remarkable uniformity of case regardless of the location of the part in the furnace or in the box. With fuel-fired furnaces, absolute dependence could never be placed on the product, since in some parts of the furnace the case of the product would be less than one-half of that in other parts, and the heat treatment was largely a matter of guesswork and compromise of results. With the electric furnace, the operation has become one of timing, so that with a certain charge, the foreman knows how long a period will be required for obtaining a definite penetration, with the assurance that the penetration will be the same throughout the entire charge.

Because of the much greater exactness of heat treatment resulting from the use of the electric furnace, it is estimated that the useful life of many of the major pieces of all the carburized parts has been more than doubled. This has resulted in less replacements of such worn parts, a very substantial saving.

Cold-rolled steel bushings average 29.32 cents per pound finished, and ready for application, including material, labor, shop expense and stores expense. The labor cost for installation averages 20 cents.

Brake and spring-rigging pins average 8.77 cents per pound, finished and placed in stock. No additional charge can be added for labor of replacement, since these pins must be removed for periodic inspection, and are then replaced if they show too much wear.

On the basis of 20 charges a month, and 1,450 lb. of

material per charge, 29,000 lb. will be heat treated per month, which will be made up of approximately 9,000 lb. of bushings, 18,000 lb. of pins, and 2,000 lb. of miscellaneous products. The values of these parts are as follows:

9,000 lb. bushing at 29.32 cents per lb. for manufacturing	$2,628.80
9,000 lb. bushings at 20 cents per lb. for installation	1,800.00
18,000 lb. pins at 8.77 cents per lb. for manufacturing	1,578.60
Total value per month	$6,007.40

Twenty-five per cent of $6,007.40 or roughly $1,500 per month represents the minimum net savings since using electric heat, for pins and bushings. The cost of heat treating these parts, a total of 27,000 lb. is $109.02. With a saving by extended life on the remaining 2,000 lb. of miscellaneous parts in proportion to that of pins and bushings, the total monthly savings and expense will be $1,560 and $117.74, respectively.

The savings in the above case is 13 times the cost of electric power. That the life of the carburized parts has been increased is also shown by the fact that one electric furnace is now handling the repair parts for which two were originally required.

Annealing Steel Castings

A coke-fired furnace was first installed at the Roanoke Shops for the heat-treatment of steel castings, then this furnace was replaced with one heated with oil. Whenever the doors of the coke furnace were opened to add more fuel, the temperature within the furnace chamber would drop from 75 deg. to 100 deg. With the oil fired furnace, a series of tests disclosed the fact that the temperature at all parts within the furnace were nowhere near the same, with the result that a great non-uniformity of physical properties was disclosed even within the same castings. A casting with many heavy sections may have one such section located either in a cold area or in a part which is slow to come up to heat, so that the surrounding temperature may be either too low, or not of sufficient duration to permit thorough penetration.

Test samples only indicate the conditions at the point of the sample. One foot away, an entirely different result may be secured. Obviously there was no system of inspection and testing that would insure a 100 per cent properly heat-treated product in a furnace heated by a high-temperature flame and convection currents. No two burners will produce exactly the same amount of heat, the heating is done more or less in spots, and is not capable of being uniformly distributed and controlled in a manner which will insure every part of every casting being properly heat treated.

A decision was made to replace the oil-fired furnace with an electric furnace, solely on the basis of producing the kind of casting having the physical properties desired. The electric annealing furnace was installed in 1927, at a total cost of $16,500. It has an electrical capacity of 540 kw., a maximum charge capacity of 20 tons, an average capacity of 12 tons, and a loading space on the car 7 ft. wide, 14 ft. long and 5 ft. high.

This furnace was charged with a test load of 13 tons, consisting of miscellaneous car castings and the following:

1—Engine saddle	3000 lb.
1—Front foot plate	1800 lb.
2—Driving boxes	600 lb.
1—Grate rest	1565 lb.
1—Driving wheel	2500 lb.
1—Back cylinder head	600 lb.
2—Driving boxes, oversize	950 lb.
3—Front cylinder heads	500 lb.
2—Chafing blocks	200 lb.
4—Truck boxes	150 lb.
4—Valve-head extensions	325 lb.

All of the above castings were given a normalizing heat treatment, which consists in heating the castings at a temperature of 1,650 deg. F., until thoroughly saturated, and then pulling the car out into the air for an air quench. The electric furnace heats uniformly top and bottom, end to end, and by allowing one hour soaking period per inch of the heaviest cross section of the casting, from the time the temperature of 1,650 deg. is reached, it has been found that the entire charge will be thoroughly heated.

The car-type furnace is operated from four to five nights each week. With a charge as above described, the furnace will require 9 hr. to reach 1,650 deg. F., and the temperature held at 1,650 deg. F., for 6 hr., making a 15-hr. heating cycle.

Some parts, such as engine frames, are given a double heat treatment for the purpose of giving such members greater ductility. This consists in heating the charge at 1,650 deg. F., for 10 hr., remove and allow to cool until black, reheat to 1,250 deg. F., for 10 hr., and remove into the air.

In addition to securing a properly annealed casting, the outstanding result was the decreased cost of machining the castings. Workmen in the machine shop praised the electric annealing furnace very highly. It is very seldom that a hard spot is now encountered, the breakage of tools is much less, more cuts are obtainable, and the steel has a much better grain or texture.

As near as could be determined, the machining costs have been decreased 10 per cent since electrically annealing the castings. There are a total of 250 machinists, 50 per cent of whom work on steel castings. At an 80-cent hourly rate, the hourly cost for machining these castings would be $100 or a monthly cost of $20,800. Since it has been estimated that the savings over previous cost is 10 per cent and the previous cost, based on present production, was $23,200, the net monthly savings in labor for machining would be about $2,400.

Power Consumption

For a 13-ton charge, with the furnace started cold, or approximately so (the current having been cut off for 32 hours), the power consumption was as follows:

Power required to reach 1,650 deg. F.	4,860 kw.-hr.
Power required after reaching 1,650 deg. F.	1,620 kw.-hr.
Total power required	6,480 kw.-hr.
Consumption per ton	500 kw.-hr.

A consumption of 500 kw.-hr. per ton is much higher than the average, since this figure was based on a test in which the furnace was not used the preceding night. In addition, the furnace door was held open for a considerable portion of the time in arranging for photographs of the charge prior to heat treatment. The furnace ordinarily would have come up to operating temperature in 7 hours with a total consumption of 5,400 kw.-hr. or 415 kw.-hr. per ton of steel castings.

A second test charge was heat treated, the charge weighing 20 tons and consisting of very heavy castings, such as locomotive driving wheels and frames. The operating data of this charge is as follows:

Total weight of charge	40,210 lb.
Time required to heat charge from atmospheric temperature to 1,650 deg. F.	11 hr. 15 min.
Time required for soaking charge at 1,650 deg. F.	9 hr.
Total time of heating cycle	20 hr. 15 min.
Power for heating up charge (11¼ hr. at 512 kw. per hr.)	5,760 kw.-hr.
Total power used	7,760 kw.-hr.
Kw.-hrs. for soaking charge	2,000
Total lb. annealed per kw.-hr.	3.18
Kw.-hr. per ton	392

Assuming a conservative estimate of 450 kw.-hr. per ton on a monthly basis of a production of 170 tons of steel casting annealed, the operating cost would be as follows:

(Concluded on page 65)

Air-Conditioning Requirements For Railway Passenger Cars*

By A. H. Candee†

A presentation of the various problems surrounding the uses of conditioned air for passenger equipment. The author herein discusses the requirements of the equipment as a whole and the advantages and short comings of different refrigerating methods and energy sources

IT is recognized that air cooling and conditioning of most of the railway passenger equipment is inevitable, once it has been shown to be practicable. Those who have had occasion to travel on the railroads in the summer time or who have entered a sleeping car which has been occupied for some time will appreciate the comfort of clean, fresh air at the right temperature. The railroads also recognize the importance of this as a means of attracting the traveling public, which is showing a marked tendency to travel by automobile, bus, or airplane rather than by rail.

The two air-conditioned cars in operation at present are in the nature of trial installations.‡ They are demonstrating the feasibility of applying refrigerating plants to railway cars for cooling purposes, but the heating systems of the cars have been unchanged. The ultimate equipment will undoubtedly have the heating system modified at the time refrigerating equipment is applied, so that the temperature of a car may be controlled at all times by the addition of heat to, or the extraction of heat from, the circulated ventilating air.

Air conditioning may be divided into three general phases:

1. Supply and circulation of cleaned fresh air.
2. Control of temperature of the air.
3. Humidity control.

For the immediate future, it is doubtful whether there will be any attempt to control closely the humidity of the air within a car because of the complications involved and the lack of space for equipment and water supply. The band of comfort to passengers is so broad that it is entirely feasible to adjust the air temperature to maintain comfortable conditions. Thus, in the winter time, a passenger will feel just as comfortable at a relative humidity of 10 per cent and an air temperature of 72 F. as at a relative humidity of 50 per cent and an air temperature of 68 F. This means that while the thermostatic temperature control will be used normally, it is advisable for the train crew to have some manual adjustment of all controlled temperatures within the cars of the train, to compensate for variations in atmospheric humidity. Such thermostatic control must permit of practically constant temperature during cold weather, but must allow of a rising interior car temperature as the exterior temperature rises, for the spread between the two should seldom exceed 15 deg. (dry-bulb), or the effect on passengers is likely to be unpleasant. The preferable differentials in temperature with average external humidity are shown by Table 1.

Table I—Preferred Interior Temperature Regulation (Exterior Temperatures above 70 Deg. F.)

External Temp. F.	Dry-Bulb Temp. F.	Interior Wet-Bulb Temp. F.	Effective Temp. F.
95	80	65.2	73.4
90	78	64.5	72.2
85	76.5	64.0	71.1
80	75	63.5	70.2
75	73.5	63.0	69.3
70	72	62.5	68.2

Basis of Air Conditioning Railway Cars

One of the greatest advantages of any system of air conditioning is the provision of clean fresh air for the passengers. The opening of passenger car windows is usually accompanied by a swirl of cinders, soot, and smoke yet at present one cannot travel in the summer time without having them open. The basis of air conditioning must, therefore, be to have all windows closed and locked, and to draw the ventilating air through a cleaning device of some sort which will exclude the dirt and dust, after which it must be properly circulated within the car to provide equal distribution without excessive drafts. Sealed double-sash windows, improved insulation, and elimination of ventilators and bracket fans will no doubt be features of the air-conditioned car. This will also make a quieter car, as external noises will be more effectually excluded.

It is not possible to locate an air intake in a railway car where clean air from the outside is insured. It is, therefore, necessary to remove the cinders, dust and dirt by artificial means, such as an air washer or a dry type of filter. While the former has the advantage of being a cooling medium and a means of controlling the humidity, the space required is a serious handicap in a great many cars. The dry type of filter will probably be used, if an air washer cannot be applied, and may even be used in series with the air washer to remove the larger particles from the air stream. Any dry type unit must be located for easy removal for cleaning purposes. It appears that the cleanest air may be obtained high in the car, near the roof. The two existing installations previously mentioned draw in air through the vertical walls of the clerestory just above the half deck of the car, where deck ventilators are normally placed.

The amount of air circulated per minute per pas-

* Abstract of a paper presented before the American Society of Heating and Ventilating Engineers at Pittsburgh, Pa., on January 27, 1931.

† Railway Engineer, Westinghouse Manufacturing Company.

‡ The Baltimore & Ohio installation is described in the *Railway Mechanical Engineer* of September, 1930, page 508. The Santa Fe installation is described in the December 1930, issue, page 696.

senger in a railway car equipped with air conditioning apparatus will vary somewhat with the particular type of car. It is clearly necessary to recirculate a portion of the air in order to reduce plant capacity required for heating or cooling purposes where limited power and space are available, and the amount of fresh air drawn from the exterior of the car will vary with atmospheric conditions and with the application. It is obvious that a dining car must have more fresh air supplied (on account of pollution due to kitchen smoke and odors) than a parlor car, and that a smoker must have considerable fresh air in order to clarify the interior atmosphere. This indicates the desirability of selective variation in the ratio of incoming fresh air to circulated air. While railway ventilation practice in the past has generally been based on 15 cu. ft. of air per minute per passenger, it is expected that forced circulation and careful distribution of the air will reduce this figure somewhat. Table 2 is submitted as a guide in determining required air circulation for different passenger compartments. On the basis of 15 cu. ft.

Table II—Approximate Data For Passenger Compartments

	Length Compartment (Feet)	Floor Area (Sq. Ft.)	Interior Volume (Cu. Ft.)	Maximum Seating Capacity	Volume Per Passenger (Cu. Ft.)
Coach	58	522	4060	100	40
Sleeper	37½	337	2740	48	57
Parlor Car	46	414	3360	26	130
Diner	39	350	2850	36	80
Smoking Room	10	65	540	6	90
Drawing Room	7	43	380	5	76

per minute per passenger, it would be necessary to change the air in a coach every three minutes, in a sleeper every four minutes, in a parlor car every nine minutes, and in a diner every five minutes as a maximum. However, since air movement assists in improving the comfort of a cooled car, it is desirable to circulate the air at a faster rate than this in the summer itme, reducing the fan speed and delivery for cold weather conditions.

From the foregoing discussion, it will be apparent that the essentials of the air circulating system include one or more air filters equipped with manually-operated shutters which may be adjusted at will, or completely closed in passing through tunnels, a circulating fan (preferably of variable manual speed control), and a suitable duct system for proper distribution of the air throughout the car and for recirculation of a portion of that air. The amount of air allowed to escape from the interior must be equal to that introduced, and with a sealed car will mean the provision of a variable vent.

Location of Heating and Cooling Units

With an air circulating system provided on a car, the best temperature control may be effected by placing both the heating and the cooling units directly in the ventilating air stream, preferably close to the fan, adding or subtracting heat as required. The location of the heating coils in this way will improve the efficiency of heat transfer and save in cost and weight over the present system of extending steam pipes along the sides of a car near the floor. The fact that it may be necessary to circulate both the heated and the cooled air through the car in the same direction will probably be unimportant in the face of practical considerations.

Steam, generated at the locomotive, has long been the source of heat for maintaining comfortable temperatures within a train in cold weather, although this inflicts a severe handicap on motive power with low ambient temperatures. An ordinary coach having a 70-ft passenger compartment requires nearly 100 hp. from the locomotive for heating under the maximum conditions in zero weather, which means that approximately half as much energy is used for heating as for train propulsion under these conditions. It is undesirable to draw power from the locomotive for auxiliary purposes if it can be avoided in any way, but the use of steam for heating cannot easily be discarded.

Methods of Cooling

For the cooling of cars in hot weather, means must be arranged for passing the ventilating air over a cold body in order to extract heat. There are three general systems available for providing such a cold body:

1.—A material having heat-absorbing characteristics, such as ice.

2.—An absorption system of mechanical refrigeration.

3.—A compressor system of mechanical refrigeration.

Differentiation between the absorption system and the compressor system has been made on account of the fact that the one employs heat direct, while the other requires mechanical energy. In considering their application to railway cars, this may be of considerable importance.

Any refrigerating method should be carefully considered from a practical standpoint, weighing the relative effects of practicability, reliability, weight, first cost, and operating expense. It may be used a maximum of 50 days a year, yet it must ride with the car for the other 315. The air circulating system, however, is used the year round.

The refrigerating system must be safe, above all else, allowing no escape of fumes within the car and no danger of explosion even in case of accident to the car. The weight, first cost, and operating expense are economic factors and must be justified on the basis of an increase in revenue, for the railroads cannot continue to provide additional comforts for the traveling public unless these comforts show returns in increased passenger traffic or unless the fare per passenger is increased.

The most common method of providing heat absorption capacity is by the use of ice. It is estimated that from one to two tons of ice will keep a car cool for at least a day under the most severe conditions if the melting is properly controlled. Such a method of refrigeration, however, requires daily recharging of the ice boxes, but compared with mechanical refrigeration, the apparatus carried on the car is simple.

Absorption systems are available for maintaining low temperatures in refrigerator cars, but the development has not yet progressed to a point where they may be applied to the air conditioning of passenger cars. The fact that heat is used in place of mechanical energy offers very attractive possibilities, as the fuel may be carried on the car itself, and may be replenished with little difficulty. It is expected that new developments in this field will be announced shortly, which will simplify the application of refrigerating systems to railway cars.

It is logical that the first air-conditioned cars should employ mechanical refrigeration, as this field has had the advantage of considerable development. The question of power supply, however, is troublesome and together with the refrigerating mechanism adds considerable to the weight and cost of a car.

There are six general methods of providing the energy required for a mechanical refrigerating system (excluding the absorption system):

1.—Steam power plant on each car.

2.—Steam power plan on or near the locomotive.

3.—Internal combustion engine power plant on each car.

4.—Internal combustion engine power plant on the locomotive or in a baggage car.

5.—Axle driven generator on each car.

6.—Axle driven generator on each car supplemented by a storage battery.

It will be noted that in methods (1), (2), (5) and (6) the energy is obtained by subtraction from the motive power, except in cases where steam may be generated in a separate boiler such as is used in connection with an electric locomotive. Method (3) renders a car independent of movement of connected motive power. With method (5) energy is supplied only when the train is in motion and it is to overcome this handicap that method (6) was devised. The Baltimore and Ohio diner employed method (5), and the Santa Fe, method (6), but alterations in the former have been made so that the cooling water pump and the ventilating fans now operate from the battery and thus continue the cooling while the car is standing for short periods. Schemes such as (2) and (4) require that electric power circuits be carried the length of the train. While such a distribution system cannot be applied in the immediate future, due to the fact that it is an immense task to apply such conductors to the number of cars involved, it is obvious that the electrical comforts and conveniences such as are found in a great many homes will ultimately be available to the railroad traveler and that this will require a dependable power system. Some of the most prominent railway electrical engineers forecast the use of such power generation and distribution on trains, with the consequent elimination of the troublesome axle-driven generators and storage batteries now in use.

For the immediate future, therefore, it may be assumed that there are several practical methods of obtaining a cold body, namely, ice carried in an insulated compartment and melted as required; absorption systems of refrigeration using a stored liquid, gaseous or solid fuel supply which may be replenished at will; a steam or internal-combustion engine-driven mechanical refrigerating plant; or equipment using an axle generator as the means of utilizing motion of the car for transmitting energy from the locomotive. Although the diners now in operation utilize axle generators, it is doubtful whether this practice will continue.

Calculations indicate that from 60,000 to 80,000 B.t.u. per hour maximum must be absorbed in order to provide effective cooling of a diner or a sleeping car. Experience has shown that this requires an input of from 10 to 13 hp. to a refrigerating plant of the mechanical type. The heat to be extracted is calculated as shown by Table 3, making due allowance for improvements in insulation of the car. Any mechanical system of cooling must have a capacity equal to the short time demand such as is indicated in Table 3, but the total capacity of any system using heat absorbing material, such as ice, may be based on an integration of the demands throughout the complete run of the car between recharging stations.

Table III—Calculation of Heat Extraction For A Sleeping Car*

	B.t.u. per hour
Heat through car walls	11,000
Solar radiation	10,000
Heat from make-up air	30,000
Passenger radiation (300 B.t.u. per hour per passenger (48) passenger maximum)	14,400
Power of blower	1,500
Loss in pipe lines	2,000
Total	68,900

* Based on following conditions: External temperature, 95 F.; internal temperature, 80 F.; time, 2:00 to 4:00 P.M.; average train speed, 30 m.p.h.; maximum conditions.

Problems to Be Solved

There are a great many problems to be solved. Who is now able to forecast the best method of refrigerating, of arranging units, of supplying energy, and of insulating cars? These questions can be answered only by experience, and trial installations such as have been made have already advanced the available knowledge considerably. It is highly probable that the resulting research will materially reduce the amount of steam used for heating, through the use of double windows fastened in place and carefully sealed, through different materials and methods of blanketing the car, and by better heat transmission from the steam pipes to the air. This factor alone, if accomplished, will represent a considerable saving to the railroads.

Many railroads are interested in air conditioning, but few feel that the weight, cost and complication of the present types of mechanical refrigerating units can be justified. It is one thing to apply such a system to a car, but it is an entirely different matter to train an organization, scattered over the country, in operation and maintenance so that the equipment will function continuously and efficiently. The problem is not alone that of the railroads, but involves the heating, ventilating and refrigerating engineers of the country, by whose efforts simple and reliable equipment can be developed. Preference will be given to those systems which employ the minimum number of working parts, the lowest operating expense, and a minimum of space.

Industrial Electric Heating For Railway Shops

(Continued from page 62)

Basic power cost per kw.-hr.	$0.008
Tons per month	170
Kw.-hr. per ton	450
Power cost per ton, average	$3.60
Power cost per month	$612.00

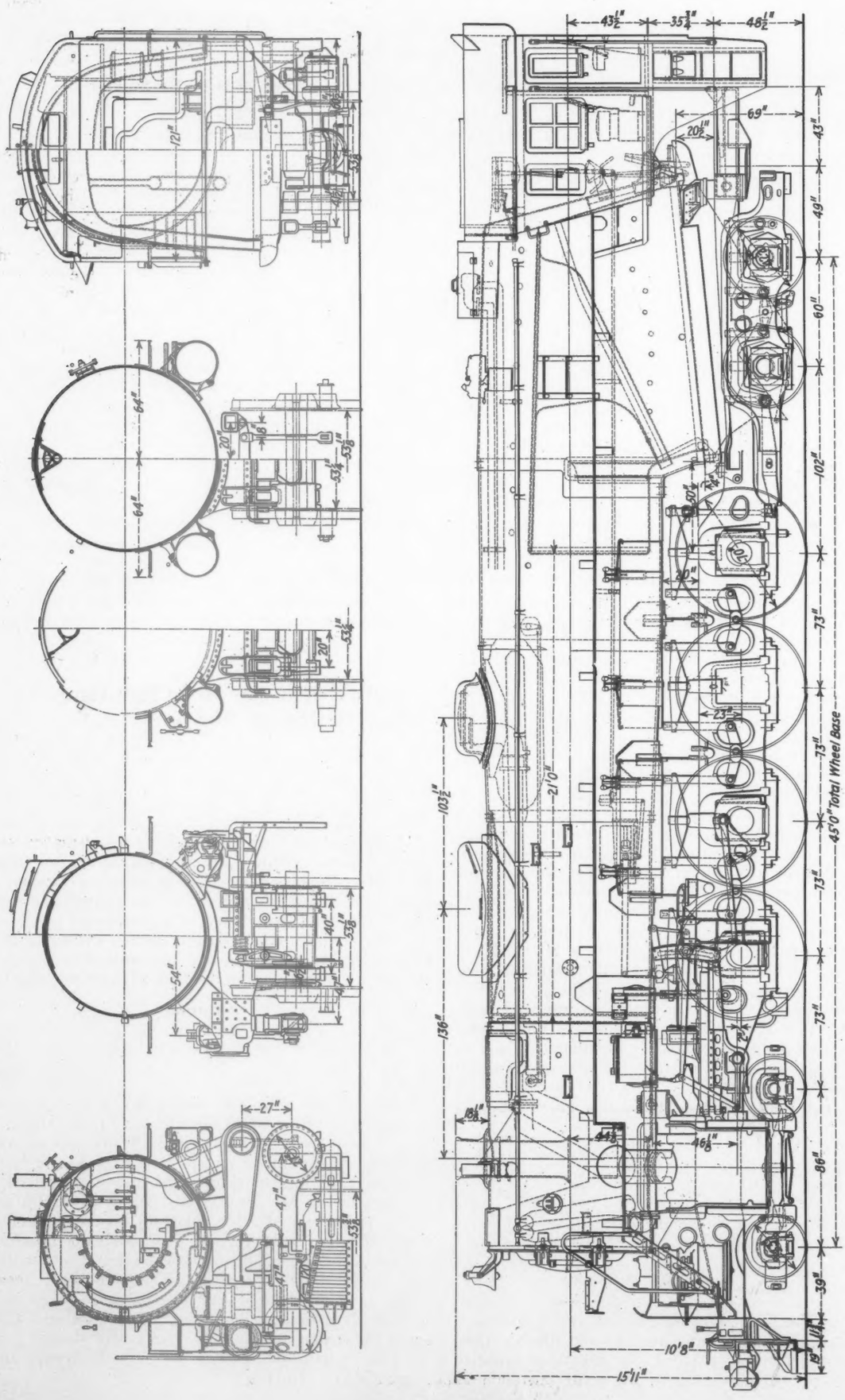
Using fuel-fired furnaces, it was necessary to have a man on duty continuously to look after the furnace. With electric heat, it has been possible to dispense with such help, since the only attention required is on the part of the night watchman, who punches a clock alongside the control panel for the electric furnace, and all he has to do is to note if the indicating lamps are burning. This saving in labor is $118.50 per month.

Summary

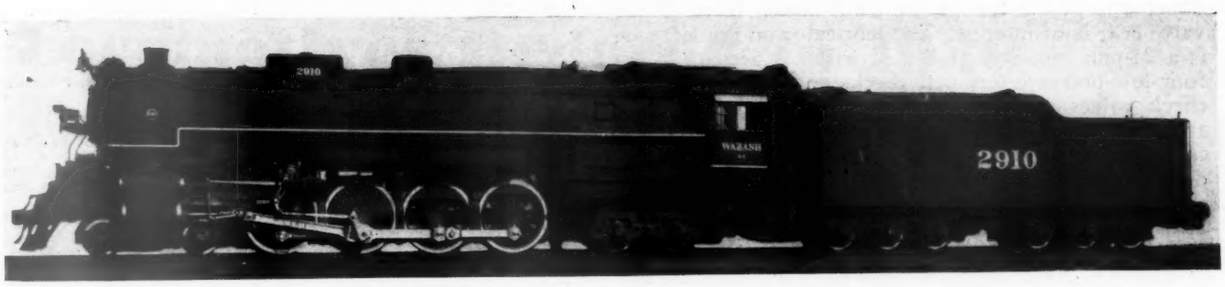
Monthly saving in machining of steel castings	$2,400.00
Monthly saving in labor of attending furnace	118.50
Total monthly saving	$2,518.50
Monthly cost of electric power	612.00

There is an additional saving not mentioned in the foregoing—that of breakage of tools on account of hitting of hard spots in the castings. There was no way of arriving at this saving except in a very vague manner. A great deal less trouble was being experienced, and as a matter of fact, it has just about been eliminated. As an indication of what this tool breakage, and additional grinding and wearing out of tools may amount to, the saving in tools, in one case analyzed, amounted to ten times the labor saving. This may have been an exceptional case, but it would seem that one could conservatively estimate the saving in tools would at least equal the saving in labor, for the entire shop.

(The conclusion of this article will appear in the March issue.—EDITOR.)



Elevation and cross sections of the Wabash 4-8-4 type locomotives built by Baldwin



Wabash 4-8-4 type locomotive built by the Baldwin Locomotive Works

Twenty-Five 4-8-4 Type Locomotives for the Wabash

Purchased to replace 4-8-2 types in through-freight service—Equipped with Type E superheater, feed-water heater, stoker, two Thermic syphons and power reverse —Tractive force, 70,750 lb.

THE Wabash recently placed in through-freight service 25 4-8-4 type locomotives which were built by the Baldwin Locomotive Works. These locomotives were purchased to replace 4-8-2 type locomotives operating between Decatur, Ill, and Montpelier, Ohio, a distance of 272 miles, with eastbound and westbound ruling grades of 0.6 and 0.9 per cent, respectively. The locomotives replaced developed a tractive force of 66,568 lb. The new power is somewhat similar in design to the 4-8-2 locomotives, except that the four-wheel trailing truck permitted a larger grate area (96.2 sq. ft.) than could be carried on a two-wheel trailing truck.

Table Showing the Principal Weights, Dimensions and Proportions of the Wabash 4-8-4 Type Freight Locomotives

Railroad	Wabash
Builder	Baldwin Locomotive Works
Type	4-8-4
Service	Freight
Cylinders, diameters and stroke	27 in. by 32 in.
Valve gear, type	{Walschaert (20) {Baker (5)
Valves, piston type, diameter	12 in.
Maximum travel	{Walschaert, 8 in. {Baker, 9 in.
Weights in working order:	
On drivers	274,100 lb.
On front truck	78,590 lb.
On trailing truck	101,400 lb.
Total engine	454,090 lb.
Tender	296,510 lb.
Total engine and tender	750,600 lb.
Wheel bases:	
Driving	18 ft. 3 in.
Total engine	45 ft. 0 in.
Total engine and tender	86 ft. 10 in.
Wheels, diameter outside tires:	
Driving	70 in.
Front truck	33 in.
Trailing truck	42½ in.
Journals, diameter and length:	
Driving, main	13 in. by 14 in.
Driving, others	11½ in. by 14 in.
Front truck	6 in. by 11 in.
Trailing truck, front	9 in. by 14¼ in.
Trailing truck, back	9 in by 14 in.
Boiler:	
Type	Ext. wagon top
Steam pressure	250 lb.
Fuel, kind	Bituminous coal
Diameter, first ring, inside	86½ in.
Firebox, length and width	144 ft. by 96¼ in.
Tubes, number and diameter	49—2¼ in.
Flues, number and diameter	214—3½ in.
Length over tube sheets	21 ft. 0 in.
Grate area	96.2 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	369 sq. ft.
Arch tubes	30 sq. ft.
Thermic syphons	96 sq. ft.
Tubes and flues	4,689 sq. ft.
Total evaporative	5,184 sq. ft.
Superheating	2,360 sq. ft.
Combined evaporative and superheat	7,544 sq. ft.
Tender:	
Water capacity	15,000 gal.
Fuel capacity	18 tons
Wheels, diameter outside tires	36 in.
Journals, diameters and length	6 in. by 11 in.
Maximum rated tractive force	70,817 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	60.36
Weight on drivers ÷ tractive force	3.87
Total weight engine ÷ comb. heating surface	60.25
Boiler proportions:	
Tractive force ÷ comb. heating surface	9.4
Tractive force × diam. drivers ÷ comb. heat. surface	658
Firebox heating surface per cent of evap. heat. surface	9.55
Superheat. surface per cent of evap. heat. surface	45.52
Firebox heat. surface ÷ grate area	5.14

The new power is equipped with American multiple throttles, piston rods and valve stems of nickel steel, Bird-Archer close-clearance blowoff cocks, Ashton safety valves, Detroit force-feed lubricators, T-Z tank-hose strainers (right side), and Nathan injectors (right side). Five of the locomotives are equipped with Baker valve gears. None of this equipment was applied to the replaced 4-8-2 type locomotives, which were described in the April, 1930, issue of the *Railway Mechanical Engineer*.

The 4-8-4 type locomotives operate at a boiler pressure of 250 lb. They have 70-in. diameter drives, 27-in. by 32-in. cylinders, and develop a tractive force of 70,817 lb. They have been designated by the Wabash as Class 0-1. The principal differences in design and special equipment between the new power and the 4-8-2 type replaced. is in the design of the boiler and firebox related to substitution of the four-wheel for the two-wheel trailing truck.

Special Equipment on the New Power

The force-feed lubricator on the right side of the Class 0-1 locomotives supplies valve oil to the valves and to the cylinders. On the left side, the force-feed lubricator supplies car oil, two feeds to each set of guides and a feeder to the flange oilers on both sides.

The operation of the force-feed lubricators from an

offset arm at the top of the combination lever of the valve gear is of interest. The lubricator on the left side is a 24-pint capacity, Model A, with six feeds. It has four low-pressure terminal checks and two flange-oiler check valves and feed nozzles. The lubricator drive arm on all 25 locomotives is 14 in. long and the lubricator connecting rod is 13 in. long. The installation was designed with the stroke at 50 per cent cut-off, and the combination lever at 90 deg. with the horizontal. The Walschaert gear has a travel of 8 in. and the Baker gear, which is installed on five locomotives, has a travel of 9 in. On 20 locomotives, with the combination lever in mid-position, 32 in. stroke, the distance from the vertical center line of the combination lever to the vertical center line of the cylinders is 49 in. With this travel and stroke, the offset arm of the combination lever is designed for a constant travel of 3⅜ in.

With the Baker-gear installation, the distance between the vertical center line of the cylinders and the combination lever in mid-position is 50½ in. The offset arm of the combination lever is designed for a constant travel of the lubricator-drive arm of 3¾ in.

The lubricator on the right side is also a Model A of 24-pint capacity. It has four feeds, four terminal checks and, like the lubricator on the opposite side, has thermostat heat control of the temperature of the oil. Its installation and operation is similar to that of the force-feed lubricator on the left side, except that the length of the lubricator-drive arm is 11 in.

The throttle for the drifting valves is located under the smoke box in front of the cylinder saddle. The piping for the installation is of double strength and is braced to prevent vibration. The installation of the piping is such as to drain off all condensation. The exhaust steam is taken for the cylinder castings immediately in front of the exhaust stand.

The Tender

The tender is of rectangular construction with a capacity for 18 tons of coal and 15,000 gal. of water. It is carried on two six-wheel cast steel trucks having 36-in. wheels with 6-in. by 11-in. journals. The water-hose connections between the tank and locomotive are provided with T-Z tender-hose couplers and strainers. The tank is constructed of copper-bearing steel.

List of Special Parts, Appliances and Equipment Applied on the Wabash 4-8-4 Type Freight Locomotives

Railroad	Wabash
Builder	Baldwin Locomotive Works
Service	Freight
Type	4-8-4
Number built	25
Firebox and Boiler	
Blower fitting	Barco
Blower valve	Okadee
Blowoff cocks	Bird-Archer
Boiler and firebox steel	Lukens
Boiler checks	Nathan
Boiler jacket	Copper bearing steel
Drifting throttle valves	Ohio Injector Co.
Feedwater heater and pump	Worthington
Firebrick arch	Economy
Fire door	Franklin
Fire door flange	O'Connor
Flexible staybolts	Flannery
Gage cocks	Sargent
Gage glasses	Nathan
Gage glass guards	Nathan
Grates	Hulson-Tuyere type
Injectors	Nathan
Injector starting valve	Sellers
Lagging	Johns-Manville
Piping	Byers-Wrought iron
Pipe wrapping	Union A. & R. Co.
Rivets	Champion
Safety valves	Ashton
Smoke box hinges	Okadee
Smoke suppressor nozzles	T-Z Railway Equip.
Smoke suppressor valve	Okadee
Spark arrester and netting	Draftac
Staybolt iron	Lewis special
Steam gage	Ashton
Steam pipe casing	Alsco
Steam valves	Hancock
Stoker	Standard-Type BK
Stoker steam gage	Ashton
Superheater	Type E
Thermic syphons	Locomotive Firebox Co.
Throttle	American Multiple
Throttle compensating lever	Jones
Throttle-rod stuffing box	Gustin-Bacon
Tubes	Pittsburgh Steel Products Co.
Flues	National Tube Co.
Washout plugs	Huron
Water column	Nathan
Whistle	Hancock
Cylinders and Running Gear:	
Back engine truck	General Steel Castings Co.
Bed frame	General Steel Castings Co.
Brake shoes	American Brake Shoe & Foundry Co.
Brasses	National Bearing Metals
Connecting rods	Carbon-Vanadium Steel
Cradle	Commonwealth
Crank pins	Carbon-Vanadium Steel
Crossheads	Laird
Crosshead guides	Laird
Crosshead Shoes	Laird
Cylinders	Cast steel
Cylinder and valve bushings	Hunt-Spiller
Cylinder and valve packing	Hunt-Spiller
Cylinder cocks	Okadee
Cylinder safety valve	Okadee
Driving box cellars	Sivyer Steel Castings Co.
Driving box lubricators	Franklin
Driving box spreaders	Alco
Driving axles	Carbon-Vanadium Steel
Driving tires	Railway Steel Spring Co.
Flange oiler	Detroit
Front engine truck	Alco
Front engine—truck centering device	Union Steel Castings Co.
Front truck axles	Carnegie
Lateral-motion device	Alco
Lubricator, hydrostatic	Nathan
Lubricator, mechanical	Detroit
Metallic packing	U. S. Metallic Packing Co.
Pedestal wedges	Franklin
Oil cups	Alemite
Power reverse gear	Alco
Rods: main and side	Carbon-Vanadium Steel
Running gear lubrication	Alemite
Springs	Railway Steel Spring Co.
Valve gear	Walschaert (20), Baker (5)
Cabs and Miscellaneous:	
Air brake gages	Ashton
Air manifold	Edna
Bell ringer	Viloco
Brakes	Westinghouse No. 6 ET
Brake-Foundation	American. WN-5
Cab apron	Ryerson
Cab seats	Gustin-Bacon
Cab windows	Prime
Cab windshields	Prime
Cut-off control gage	Ashcroft
Draw bars, engine and tender	Franklin
Engine coupler	National Malleable Castings Co.
Front bumper	General Steel Castings Co.
Headlight equipment	Pyle National
Markers, classification lamps	Pyle National
Paint	Mountain Paint & Varnish Co. (20) Duco (5)
Radial buffer	Franklin
Rerailers	Buda
Sanders	Graham-White
Steam Heat	Vapor
Wiring	American Steel & Wire Co.
Tender:	
Coupler retainers	Western Ry. Equip. Co.
Draft gear	W. H. Miner
Engine and tender connections	Barco
Farlow attachments	Symington Co.
Material for tanks	Lukens, copper-bearing steel
Tank hose	Gustin-Bacon
Tank hose strainers	T.-Z.
Tank valves	Everlasting
Tender coupler	National Malleable Castings Co.
Tender coupler centering device	Union Metal Products Co.
Tender frame	General Steel Casting Co.
Tender journal boxes	Symington Co.
Tender journal-box dust guard	J. H. Sharp
Tender journal-box wedges	Railway Devices Co.
Tender trucks	General Steel Castings Co.
Tender-truck side bearings	W. H. Miner
Tender wheels	Standard Steel Works Co.

ONE HUNDRED YEARS AGO.—The "Best Friend," the first locomotive built in the United States for service, successfully attained a speed of 35 m.p.h. on December 14, 1830, on the South Carolina [now part of the Southern] while running light.

Locomotives Ordered in 1930 Reflect Business Depression

Total domestic orders lowest since 1921 while Canadian orders increase — Timken roller-bearing and D. & H. 500-lb. pressure locomotives feature year's construction

ONLY 440 locomotives were ordered during 1930 for service in the United States. This number is the lowest since 1921 when 239 were ordered and, as shown in Table I, is the third lowest total number of locomotives ordered for domestic service since 1918. On the other hand, Canadian orders for 95 locomotives is an increase over the number ordered in previous years. With the single exception of the 98 locomotives ordered in 1928, the total orders placed in 1930 exceeded those of previous years back to 1920. The business depression is reflected in the total of 555 locomotives ordered from builders on this continent, including those for export, which is the lowest number ordered in the past 30 years. The explanation is found in the past year's trend of railway traffic and earnings; the depressed condition of railway business has forced railway executives into vigorous programs of retrenchment. In such a state of circumstances equipment buying, along with other railway purchasing, was no doubt held to the irreducible minimum.

It should be pointed out, however, that modern locomotives are far more powerful and far more costly than those of the days when yearly orders totaled thousands.

Modern Demands Have Made Some Types Obsolete

Table II shows the types of locomotives ordered during 1930 for service in the United States and Canada,

Table I—Orders for Locomotives Since 1918

Year	Domestic	Canadian	Export	Total
1918	2,593	209	2,086	4,888
1919	214	58	898	1,170
1920	1,998	189	718	2,905
1921	239	35	546	820
1922	2,600	68	131	2,799
1923	1,944	82	116	2,142
1924	1,413	71	142	1,626
1925	1,055	10	209	1,274
1926	1,301	61	180	1,542
1927	734	58	54	846
1928	603	98	27	728
1929	1,212	77	106	1,395
1930	440	95	20	555

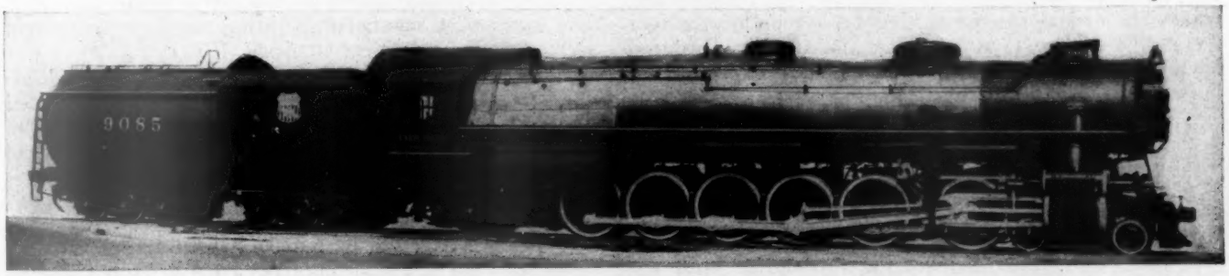
and built by North American builders for export. Of some interest in connection with the information given in this table is the demise of three types of locomotives which were once popular in this country; namely, the American 4-4-0 type, the Atlantic 4-4-2 type, and the Mogul 2-6-0 type. No four coupled locomotives have been ordered for railroad service during the past two years. One 4-4-0 type was ordered in 1928, 2 in 1927 and none in 1926. No Atlantic 4-4-2 types have been ordered since 1925. None of the 2-6-0 type, formerly popular in freight service, have been ordered for railroad service since 1928. Orders for Mogul locomotives have been steadily declining since 1920, when the tabulation as shown in Table II was first published in the *Railway Mechanical Engineer*. The 4-6-4, the 4-8-2 and 4-8-4 types are being largely ordered for passenger service, and the four- and five-coupled types with two-wheel engine trucks and four- or two-wheel trailing trucks, for freight service.

Orders in 1930 for eight-wheel switchers exceeded by 50 per cent the total number ordered of any other type. The 141 switchers ordered composed over 30 per cent of the total orders placed by the railroads.

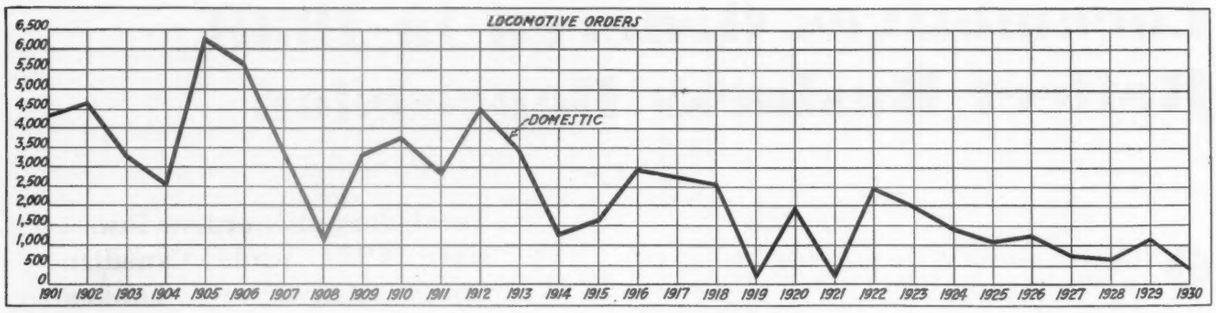
Table II—Types of Locomotives Ordered in 1930

Type	Railroad	Industrial	Export	Total
0-4-0	0	32	2	34
0-4-2	0	1	0	1
0-6-0	6	10	0	16
0-6-2	0	1	0	1
0-8-0	141	1	0	142
0-10-0	1	0	0	1
2-6-2	0	1	0	1
2-8-0	23	0	1	24
2-8-2	12	3	5	20
2-8-4	10	0	0	10
2-10-0	14	0	0	14
2-10-2	12	0	1	13
2-10-4	70	0	0	70
Articulated	22	1	0	23
4-6-0	0	0	1	1
4-6-2	9	0	1	10
4-6-4	72	0	0	72
4-8-0	4	0	0	4
4-8-2	11	0	1	12
4-8-4	12	0	0	12
4-12-2	25	0	0	25
Oil-electric or gasoline	6	15	4	25
Electric	19	0	4	23
Unclassified	0	1	0	1
	469	66	20	555

The Van Sweringen lines were the buyers of the largest number of locomotives during 1930, their combined purchases totaling 130. Of this total the Chesapeake & Ohio ordered 105, the Pere Marquette, 15, and



Union Pacific three-cylinder 4-12-2 type locomotive, built by the American Locomotive Company



Locomotive orders from 1901 to 1930

the Erie, 10. Other large purchases were made by the New York Central, which ordered 65 (30 for service on the New York Central, 10 for the Cleveland, Cincinnati, Chicago & St. Louis and 25 for the Boston & Albany), and the Union Pacific System, which ordered 15 for the Oregon Short Line and 10 for the Union Pacific. The Chicago Great Western ordered 21 locomotives during the year while the New York, New Haven & Hartford purchased 10 electric locomotives.

The continued trend toward the modern wheel arrangements is illustrated in Table III, which shows the orders placed since 1922 by the railroads in the United States and Canada for the principal types of steam and

this locomotive appeared in the June, 1930, issue of the *Railway Mechanical Engineer*. This locomotive, up to the middle of November, has been operated in New York Central freight service, Pennsylvania freight and passenger service, and Chesapeake & Ohio freight and passenger service. The mileage at the termination of the Chesapeake & Ohio test was 32,893 miles, of which 14,999 were operated in passenger service. It is planned to continue these demonstration tests for 100,000 miles.

The tests thus far indicate that the roller bearing provides a means of developing a locomotive which is suitable for both freight and passenger service. The Timken locomotive was not designed for heavy drag

Table III—Orders Placed by the Railroads in the United States and Canada During the Past Nine Years, for the Principal Types of Steam and Internal-Combustion Locomotives and Rail Cars

Year	2-8-0	2-8-2	2-8-4	2-10-2	2-10-4	4-6-2	4-6-4	4-8-2	4-8-4	Articulated			Diesel Oil-electric or Gasoline	Rail Motor-Cars
										Simple	Compound	Total		
1922	73	1,231	0	157	0	299	0	158	0	0	116	116	0	49
1923	71	534	0	167	0	194	0	140	0	0	53	53	0	71
1924	61	582	0	31	0	167	0	113	0	4	30	34	0	112
1925	17	247	25	115	10	93	0	235	0	21	1	22	14	136
1926	31	220	70	25	0	193	15	326	22	0	17	17	15	135
1927	9	71	82	17	47	49	59	30	61	22	0	22	13	164
1928	6	55	42	15	46	7	35	151	63	28	0	28	4	163
1929	7	79	50	22	52	13	115	249	172	58	10	68	61	132
1930	23	12	10	12	70	9	72	11	12	12	10	22	6	53

internal-combustion locomotives, and rail cars. Although the figures showing the orders for types placed during 1930 can hardly be used as examples to indicate trends in locomotive design, still it is of interest to note that the orders for 2-10-4, 4-6-4 and articulated types compare favorably with those of preceding years. Of the articulated types ordered, 12 were single expansion and 10 were compound.

Three railroads, as shown in Table IV, ordered locomotives of the 2-10-4 type. The ten of the 2-8-4 type were ordered by the New York Central for service on the Boston & Albany. The 72 of the 4-6-4 type and 12 of the 4-8-4 type listed in Table III were distributed among eight roads, as shown in Table V. Forty-five of the 4-6-4 type, or 62.5 per cent of the total of that type ordered, were purchased by the New York Central. The orders for the twelve 4-8-4 type locomotives were divided between two railroads, 10 being ordered by the St. Louis-South Western and two experimental locomotives for the Lehigh Valley.

Outstanding Locomotives Built During 1930

Three designs were completed and placed in operation last year which were advance steps in the efforts to secure increased capacity and improved efficiency with the steam locomotives. The first of these designs was the 4-8-4 type roller-bearing locomotive built for the Timken Roller Bearing Company. A description of

service, but it has handled trains comprising 132 cars, totalling 9,864 tons, excluding the locomotive, starting the train without difficulty. The valve events are not proportioned for this heavy drag service. Reports received from various reliable sources indicate that the Timken locomotive is performing exceptionally well in heavy passenger and fast freight service.

The second locomotive of unusual design placed in service last year was the Delaware & Hudson 2-8-0 type locomotive carrying 500 lb. boiler pressure. This locomotive named the "James Archbald," is the third of the high-pressure series of locomotives being developed by that railroad. It was described in the July, 1930, issue of the *Railway Mechanical Engineer*, page 387. No reports relative to the performance of the "James Archbald" have as yet been made available. The locomotive has been operating regularly in freight service since its delivery in April, 1930.

The 40 heavy 2-10-4 type Chesapeake & Ohio locomotives referred to earlier in this article were ordered in January of last year and delivered in September and October. These locomotives, which were described in the November, 1930, issue, page 614, are the largest and most powerful two-cylinder locomotives ever built.

The Baltimore & Ohio has recently placed in service four locomotives, the designs of which are of unusual interest. Two of the locomotives are 4-8-2 types, one of which has a radial-stay firebox and the other a water-

Kentucky & Indiana Terminal 0-6-0 type switching locomotive built by Lima Locomotive Works, Inc.

tube firebox. The other two are 2-6-6-2 types, single expansion, one having a radial-stay firebox and the other a water-tube firebox. All four locomotives operate at 250 lb. pressure. The articulated locomotives have 70-in. drivers. Descriptions of these locomotives will appear in an early issue of the *Railway Mechanical Engineer.*

Table IV—Orders for Locomotives Having Two-Wheel Engine Trucks and Four-Wheel Trailing Trucks

Road	Type	No. ordered	Weight, lb.	Tractive force, lb.
Bess. & Lake Erie	2-10-4	7	503,290	109,935
	2-10-4	2	506,970	109,935
Boston & Albany	2-8-4	10	396,100	81,400
Chesapeake & Ohio	2-10-4	40	566,000	106,584
Chi. Great Western	2-10-4	21	460,200	97,900

Six Oil-Electric Locomotives Ordered in 1930

Only six locomotives with internal-combustion power were ordered by the railroads last year. Three of these were designed to utilize three sources of power; namely, oil engine, overhead trolley or third rail, and storage battery. Two of these locomotives were ordered by the New York Central and the other by the Chicago,

Table V—Orders for Locomotives Having Four-Wheel Engine Trucks and Four-Wheel Trailing Trucks

Road	Type	No. ordered	Weight, lb.	Tractive force, lb.
Boston & Albany	4-6-4	5	356,500	55,320
	4-6-4	10	355,200	55,400
Canadian National	4-6-4	5	356,400	43,300
Canadian Pacific	4-6-4	10	350,900	45,200
C. C. C. & St. L.	4-6-4	10	.....	....
Lehigh Valley	4-8-4	1	425,000	66,400
	4-8-4	1	426,000	66,700
Maine Central	4-6-4	2	312,590	41,300
New York Central	4-6-4	30	.....	....
St. L. South West	4-8-4	10	425,000	61,500

Rock Island & Pacific. They are rated at 1,665 hp. and weigh 257,000 lb. and 254,300 lb. respectively. The Chicago & North Western, Chicago, Burlington & Quincy and the Canadian National each ordered one internal-combustion unit. All six of these locomotives were ordered for switching service.

Last year's orders for this type of locomotive, as shown in Table III, came very close to the low record of four in 1928. Orders for 61 in 1929 constitute the best record thus far established. However, the orders placed last year by the railroads amount to only 24 per cent of the total number of internal-combustion locomotives ordered. Fifteen oil- or gas-electric locomotives were ordered by the industrial concerns, and four were ordered for export, a total of 25 locomotives.

Orders for Rail-Motor Cars

The railroads in the United States and Canada ordered 53 rail-motor cars and 9 trailers during 1930. As with other types of equipment, this marks a decided recession in the number of motor cars ordered in previous years. The number of rail-motor cars and trailers ordered during the past four years is shown in a table listing the types of passenger equipment ordered, which is included in an article elsewhere in this issue, reviewing the freight- and passenger-car orders in 1930.

Table VI—Power Plant Capacity of Rail Motor Cars, U. S. and Canada

Horsepower	1925	1926	1927	1928	1929	1930
100 or less	13	14	2	5	6	2
Over 100 to and including 125	5	7	..	1	3	..
Over 125 to and including 150	9	..	..	4	1	..
Over 150 to and including 175	20	1	..	1	..	..
Over 175 to and including 200	49	3	3	1	..	..
Over 200 to and including 250	36	65	43	13	2	..
Over 250 to and including 300	2	26	76	64	15	7
Over 300 to and including 350	..	..	..	30	2	2
Over 350 to and including 400	2	..	..	18	64	25
Over 400 to and including 450	..	8	7	6	2	..
Over 450 to and including 500	..	11	1	4	5	..
Over 500	..	..	8	15	30	17
Unclassified	..	..	24	1	2	..

Although the number of cars ordered is relatively small, an analysis of the orders according to power-

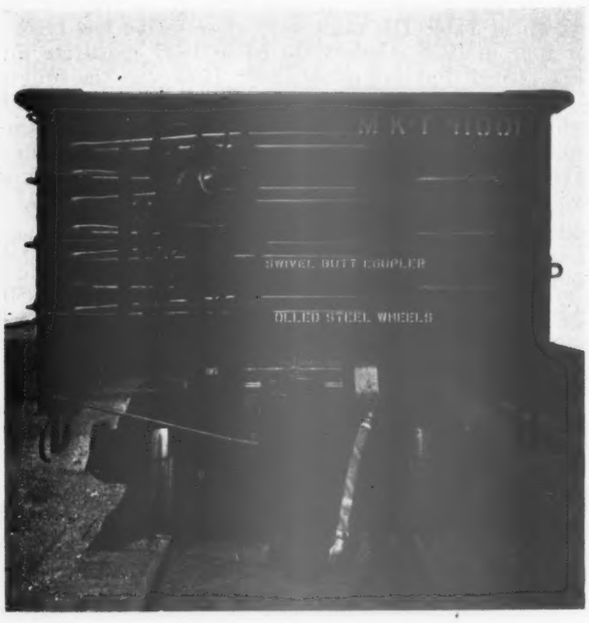
(*Concluded on page 76*)

Minneapolis & St. Louis 72-ft. mail and baggage car powered with a Model 148 400-hp. Electro-Motive oil engine—Car built by the St. Louis Car Company

Katy Builds 70-Ton Gondolas

THE Missouri-Kansas-Texas Lines is building at the Denison (Texas) car shops 500 all-steel, solid-bottom gondola cars. The cars are primarily designed for the hauling of chat, sand and gravel, of which a considerable quantity is handled by the railroad and for which suitable heavy equipment has not been available.

The cars are made entirely of steel, except the floor, for which 2¾-in. black gum creosoted decking is used. Copper-bearing steel is used throughout the car in all steel plates and pressings. The body of the car has an inside length of 41 ft. 3 in., inside width of 9 ft. 3 in., and an inside height of 4 ft. 8 in. The center sills are



End-view of car showing modern equipment, including bottom-operated swivel butt coupler

made up of two 40.3-lb. A.R.A. center-sill sections with a ⅜-in. by 24-in. cover plate of copper-bearing steel. The side sills consist of 10-in., 30-lb. structural channels. Crossbearers and cross-ties consist of 5/16-in. copper-bearing steel pressed diaphragms. The sides are ¼-in. thick copper-bearing steel and are braced by eight 5/16-in. pressed copper-bearing steel flanged U-shape posts. The side and end plates consist of 5-in. by 3½-in. by ⅜-in. bulb angles.

In building the car, every precaution was taken to assure long life of the steel members by the use of rust preventative material. The whole underframe was painted with car cement and the top surface of the underframe covered with three-ply roofing paper laid in car cement of trowel consistency. All metal joints were laid in red lead and all crevices were thoroughly filled with the same mixture after the parts were assembled.

The cars have a capacity of 140,000 lb., a load limit of 161,100 lb., and a light weight of 48,900 lb. The

Assembly operations underway at modern-equipped steel car shop of the Katy at Denison, Tex.

cubical capacity, level full, is 1,780 cu. ft., and 2,250 cu. ft. when heaped.

The trucks have cast-steel side frames with journal boxes cast integral and are of the Dalman design with one-level springs. E. S. Woods forged-steel truck roller side bearings are applied. The truck frames have Mobil, Type A, brake-hanger brackets. The wheels are 33-in. rolled steel Multiple-wear wheels.

Waugh No. 403 draft gear is used in connection with Farlow attachment and Symington swivel-butt couplers; the couplers are of the bottom rotary-operated type. The cars are also equipped with Dreadnaught steel ends and Union centering devices for radial couplers.

Particular attention was given to the piping of the cars and, in order to eliminate threaded joints, the brake pipe is welded. It is secured by Wright pipe clamps.

Ureco hand brake is used and the brake step is of metal furnished by the Morton Manufacturing Company.

An efficiently-designed car which will earn revenue for a long period with little maintenance

Machine Tools and Shop Equipment Ordered in 1930

DURING the past year 84 railroads in the United States, Canada and Mexico, representing 88 per cent of the total route mileage of the North American Continent, reported the purchase of 2,316 units of machine tools and shop equipment. This total is 374 units less than the total number purchased during the preceding year when 88 railroads, representing 89 per cent of total route mileage of the continent, placed orders for 2,690 units.

Machine Tools and Shop Equipment Purchased Over a Seven-Year Period

	1930	1929	1928	1927	1926	1925	1924
Lathes							
Axles	25	36	28	27	72	47	35
Engine	84	134	115	149	236	178	209
Turret	24	48	38	33	55	51	93
Wheel	24	25	11	14	32	34	26
Drill Presses							
Radial	31	42	31	48	93	65	71
Vertical and others	35	121	63	92	203	114	107
Planers	13	19	12	23	39	25	40
Shapers	20	53	42	46	75	70	74
Slotters	2	11	6	8	7	9	13
Boring Mills							
Horizontal	4	7	8	4	13	13	16
Vertical and others	31	53	46	49	93	56	64
Milling Machines							
Universal	2	4	5	8	26	15	18
Horizontal and others	16	53	24	19	37	23	32
Grinding Machines							
Cylindrical	2	8	13	10	20	9	13
Internal	8	13	27	32	20	36	20
Surface	1	27	10	10	22	14	17
Double end, tool and others	182	258	224	236	346	232	190
Metal cutting saws	28	35	29	31	68	40	36
Portable boring, facing and turning machines	29	30	34	29	80	58	51
Bolt threaders and cutters	13	43	27	30	54	53	54
Pipe cutters and threaders	22	50	35	45	66	40	42
Presses							
Wheel	20	13	4	17	24	22	20
Others	30	33	50	42	74	60	58
Hammers							
Steam	7	8	18	12	37	34	19
Other power	13	15	21	18	24	10	12
Forging Machines							
Bulldozers	4	5	2	9	5	6	11
Others	3	20	3	5	20	6	12
Punches	3	10	10	4	30	15	13
Shears	18	36	42	23	72	31	41
Combination Punch and shear	8	16	16	20	39	33	22
Flue Shop Machinery							
Flue welders	5	7	9	12	16	7	22
Miscellaneous	4	20	14	24	11	19	32
Boiler Shop Machinery							
Flangers	1	6	9	4	17	21	17
Forming rolls	3	12	9	9	14	9	12
Riveters	12	37	7	5	15	8	..
Blowers	37	40	53	37	100	97	..
Furnaces							
Oil	32	52	64	53	68	63	..
Electric and others	27	118	43	27	18	96	..
Woodworking Machinery							
Boring machines	4	15	11	12	9	8	10
Mortisers	5	15	9	11	21	16	13
Surfacers and jointers	23	16	18	15	43	17	17
Tenoners	4	13	7	5	11	11	12
Wood cutting saws	19	31	33	57	93	64	62
Others	25	40	32	24	39	44	32
Overhead cranes	17	81	39	32	50	23	..
Car and loco. hoists and drop tables	40	65	60	63	24	14	..
Hoists							
Air	84	66	75	53	116	101	..
Electric	82	177	44	56	54	51	..
Chain	34	30	42	85	41	78	..
Trucks							
Electric	71	64	90	55	98	114	..
Gas	66	126	65	33	76	17	..
Trailers	785	157	395	132	135	85	..
Air-brake test racks	11	10	30	43	28	24	..
Air compressors	39	66	52	64	82	54	..
Motors	115	124	101	122	138	27	..
Electric welders	69	96	72	46	158	110	..

The 2,316 units ordered in 1930 also represents a decrease of 61 units under the purchases of 1928 when 87 railroads, representing 85 per cent of the total route mileage, placed orders for 2,377 units of this type of equipment. Although the purchases of last year fell below those of the preceding two years, they represent an increase of 44 units over the orders placed in 1927 when 99 railroads, representing 88 per cent of the total route mileage reported their orders. Compared with the purchases of 1926 when 97 railroads, representing 84 per cent of the total route mileage, purchased 3,457 units of this type of equipment, the 1930 orders represent a decrease of 1,141 units.

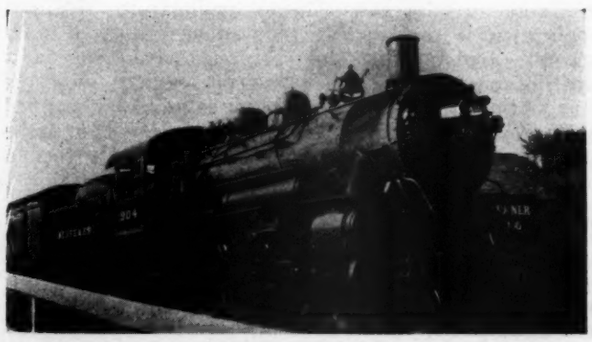
Although the general trend in the purchases of this class of equipment during 1930 was downward, the orders placed for several types of machine tools closely approximated the number purchased during the preceding year. Of these, the number of orders placed for wheel presses was the most outstanding, 24 being ordered last year as against 25 in 1929. Orders for portable boring, facing, and turning machines which were placed last year, number 29 as against 30 for the preceding year. It is noteworthy that the 1930 purchases of various types of presses exceeded those of the preceding year, 50 of these machines being bought in 1930 as against 46 in 1929. The number of power hammers purchased during 1930 closely approximated the number purchased during 1929, 20 of them being bought last year as against 23 during the preceding year.

Although, as a class, there were fewer forging machines purchased during 1930 than during the preceding year, the railroads bought 4 bulldozers last year as against 5 in 1929. The orders for flue welders in 1930 numbered 5 as against 7 in 1929, while the orders for various types of blowers last year numbered 37 as compared with 40 for the preceding year. In orders placed for woodworking machines, surfacers and jointers alone exceeded the 1929 orders, 23 such machines being purchased in 1930 as against 16 in 1929.

Material-Handling Equipment

During the past year there was an increase in the purchases of air and chain hoists, but a decrease in the purchases of electric hoists. The only group of equipment which showed a marked increase in purchases during 1930 was that of electric trucks, gas trucks and trailers, although individually the orders placed for gas trucks during 1930 were considerably less than the orders placed in 1929. The orders placed for electric trucks increased slightly, while the number of trailers ordered was practically double the number recorded for 1928.

* * *



From collection of Geo. M. Sittig
Bessemer & Lake Erie 4-6-2 type locomotive built at Schenectady, N. Y., in 1913

Roller Bearings for Locomotives and Cars

A summary of selected questions and answers bearing upon the design, operation and future possibilities of this type of equipment in the railway field

AT a meeting of the Central Railway Club of Buffalo on November 13, 1930, T. V. Buckwalter, vice president of the Timken Roller Bearing Company, presented a paper entitled, "Roller Bearings for Locomotives and Freight cars." Essentially the same paper was presented a month later at a regular meeting of the Railway Club of Pittsburgh. That the presentation of this paper before these two organizations was received with a great deal of interest is evidenced by the fact that a number of questions bearing upon the design, operation and future possibilities of this type of equipment were asked. An abstract of the paper was published in the Railway Age for November 29, 1930 on page 1177. A complete description of the Timken demonstration locomotive was published in the June, 1930 *Railway Mechanical Engineer* on page 316. Many of the questions that were brought up in the discussion at the two railway clubs mentioned are of such general interest that a selected group of these questions have been taken for publication in this article. (*The questions in each case were asked by members on the floor and, for the information of the reader, all of the answers were given by Mr. Buckwalter.*—EDITOR.)

Discussion at the Central Railway Club of Buffalo

Question: Is the application of roller bearings to locomotive rods contemplated?

Answer: It is recognized that the rod is an application requiring considerable study. In fact, it is a study by itself. There was a certain amount of uncertainty in building a roller bearing. It was decided to attach the wheels first and apply the bearings to the roads at the expiration of 100,000 miles. There is a small locomotive which has been operating since last April equipped with roller bearing rods and the service to date has been satisfactory.

Question: In connection with the application of roller bearings to main and side rods, particularly at the back end of the main rod, what means are you going to employ to lubricate the bearing?

Answer: The application of roller bearings is a difficult problem inasmuch as a stationary housing is not available which may be readily extended to provide a reservoir for lubricant. The oil available for side rod application is considerably reduced as compared with an axle application. The experience available on a small locomotive and on stationary engines indicates that lubricant is retained in a more satisfactory manner than would be apparent on the surface. The probabilities are that a special lubricant will be advisable for side rod roller bearing applications.

Question: Have you had any hot bearings on the Timken roller bearing locomotive so far?

Answer: There has been no trouble with the roller bearings. However, some troubles were experienced with hot rod bearings on the original runs. The original installation comprised the conventional press-fitted rod bushings. The original installation was apparently slightly out of tram and the wide disparity between roller bearings on the axle and the plain bearings on the rods led to the severe punishment of the latter. This is apparently due to the facts that the roller bearing surrounds the axle 100 per cent and has tremendously greater capacity than the side-rod bearings. A slight inaccuracy in tramming led to the punishment of the latter. The trouble with the side rod bearings was eliminated entirely by re-tramming and by the use of floating bronze bushings.

Question: How many miles is this roller bearing locomotive expected to run before requiring repairs or renewal to the roller bearings?

Answer: That is a difficult question to answer. Our expectation is that the bearings will have a life in excess of 250,000 miles. This is based on our experience with heavy loads sustained 24 hours a day after a period of years in steel mill service. It will be recalled that roller bearings in steel mills are still operating after rolling 400,000 tons of steel, 17 passes to the ton, or a total of 7,000,000 tons of steel having passed over the bearings. Our expectations are that some bearings may fail in 250,000 miles; that some bearings will operate for 1,000,000 miles. It would not be surprising if an average life of 500,000 miles would be obtained.

Question: What is the special method of crowning used in connection with the floating split bearings?

Answer: We line the rods with a steel liner made out of exceptionally hard steel and that liner is reverse crowned, the radius of the crown being equal to the spacing between the drivers—roughly, 77 in. The floating bronze bushing is crowned to correspond with these liners in the rods. The bore of the bronze bushing is parallel and fits the pin. The theory is that the floating bushing alines itself with the reciprocating motions of the rods and allows the pin to get a full contact with the floating bushing.

Question: How are the shoes and wedges fitted?

Answer: Pounding occurs only in the presence of lost motion. A pound cannot develop on closely fitted surfaces. It is not possible to strike a blow without first lifting the hammer. The roller bearing has a very slight movement and the piston thrusts are sustained by a complete steel train of parts. The lost motion in the bearing itself is negligible, the looseness within the bearing being so slight as to be completely absorbed by the oil film. The bearing housing and the trunnion guides are mounted so as to move freely in the pedestals but inasmuch as these surfaces are all hardened steel and lubricated, the tendency to pound is corrected. It is apparent that the absence of pound is explained by the fact that the axle is completely surrounded by the bearing.

Question: How are the housings built on the drivers?

Answer: The lubrication of the locomotive has been

worked out in a thorough manner. No necessity has arisen for renewing lubrication after 35,000 miles of operation. Samples have been taken from the lubricant, however, for analysis, as this analysis provides a certain and simple test for the presence of alloys as used in bearing manufacture. It is not considered advisable to operate for periods longer than from three to six months because of deterioration of the lubricant and the increase of the moisture content of the lubricant.

Question: What kind of oil do you use in the roller bearings?

Answer: We are using the regular valve oil on these bearings. There has been quite a difference of opinion to the type of lubricant necessary for roller bearings. The chief characteristic necessary in a lubricant for a roller bearing is that it protects the bearing from foreign matter, moisture and grit. It does very little in reducing friction because the roller bearing itself reduces the friction. We use valve oil on the locomotive because it is available at all enginehouses. We use car oil in passenger car bearings and generally use car oil in the freight car bearings. If some railroads desire to use some other oil that is special with them we, as a rule, have no objection although we are careful to analyze it and see that it is suitable before approving it. As a rule, any satisfactory railroad oil operates very nicely on roller bearings.

Is the application of roller bearings to main and side rods contemplated? If so, what means of lubrication are going to be employed to oil them? Is it possible to apply roller bearings to the crossheads and guides? In what distance could a freight train equipped with roller bearings be stopped? What is the approximate increase in cost of a roller-bearing equipped locomotive over the same type of locomotive without roller bearings? In the accompanying article, answers to these and other questions are made by T. V. Buckwalter, vice president of the Timken Roller Bearing Company.

Question: Is it possible to apply roller bearings to the crossheads and guides on a locomotive?

Answer: A crosshead application of roller bearings will require some means to enclose the rollers and working surfaces. Otherwise, the surfaces and the rollers would be subject to wear because of exposure to dust and grit in the atmosphere. The crosshead application that has been made on the Timken locomotive promises an immediate relief involving, as it does, a hardened steel guide in connection with tin-lined crosshead shoes. The grit that is embedded on the tin is not sufficiently hard to cut the hardened steel guides. Consequently, the rate of wear, friction and the heating is greatly reduced. The experience of machine tool builders at the close of the war is of particular interest in connection with the study of present-day operating costs. The machine tool builders emerged from the war without any business and with greatly expanded plant facilities which had been made during the war. They utilized this opportunity to develop an entirely new line of tools adaptable to every class of work. These machines were capable of making such improvements in quality and reduction in operating costs that the machine tool users found it advantageous to scrap their existing plant equipment and purchase an entirely new complement of equipment. This not only reinstated the machine tool industry but effected important economies in the production of nearly all articles of manufacture. An example is the reduction in cost and selling price of automotive equipment. There are numerous manufacturing interests that re-equipped their plants throughout with the machine tools available during the last decade and have not only effected immediate reductions in manufacturing costs but have obtained these advantages with an improvement in quality. Manufacturers that have not taken advantage of these improvements in machine tools have, as a general rule, passed out of the picture. It is apparent, therefore, that the best defense against conditions experienced at the present time is to discover some means of reducing the cost of operation. The roller bearing is offered as one method of effecting this reduction. The general adoption of the plan of rehabilitation on the part of the railroads would undoubtedly lift the country from the depression in which it finds itself at the present time.

Question: Mention was made about freight trains equipped with roller bearings. What would be the difference in distance required to bring such a train to a stop as compared with one equipped with plain bearings?

Answer: The roller friction is about one-fourth of one per cent, probably a little less than that. The braking friction is about 25 per cent. If we assume these figures to be correct, the braking friction is 100 times the rolling friction. From these figures if a plain bearing car could be stopped at a certain speed in 100 ft., the roller bearing car could be stopped with the same application of brakes in 101 ft. The increased distance is between one-half and one per cent in order to make a stop at a given point.

Discussion at the Railway Club of Pittsburgh

Question: Approximately what is the increase in cost of a roller-bearing equipped locomotive over the same type of locomotive without roller bearings?

Answer: The additional cost of the roller bearing locomotive at the present time is about 10 per cent greater than the corresponding plain bearing locomotive. These figures will be subject to considerable revision as we obtain more experience in manufacturing housings and fittings to accommodate the bearings. The bearings themselves are not so much more expensive but some of the housings and fittings are, particularly the hardened steel parts required to resist the piston thrust. I think the additional cost of 10 per cent is a fair figure. At least, it is as accurate as anything we know at the present time. In taking this cost of 10 per cent, consideration should be given to the additional power the roller-bearing locomotive develops over and above that of the corresponding plain bearing locomotive. I do not know of any eight-coupled plain bearing locomotive that develops over 3,800 h.p. at 40 m.p.h. If the roller bearing locomotive of corresponding size develops 4,600 hp. that is a material advantage, particularly at high speeds at which freight must be operated in the future in this country to compete with trucks.

Question: What effect would water in the bearing housings have on operation? (This question was asked by a representative of a road which experiences flood conditions frequently.)

Answer: If a locomotive or car operates through water of sufficient depth to flood the housings, the oil and water must be drawn out and fresh oil added within a few days. There is no immediate danger because corrosion is rather slow and does not have any immediate effect, but if the water should remain in the housing for a period of months, it would certainly attack the roller bearings.

Question: The speaker has mentioned the application of roller bearings to locomotive engine trucks. No doubt he has made a study of the thrust on such bearings. Most all roads have had trouble with fire-cracks due to the terrific heat developed on account of thrust. Are there any figures available on the amount of such thrust?

Answer: The best information available is, that the thrust may amount to about 80 per cent of the weight. That figure is about twice what we figure on freight- and passenger-car thrust reactions. The bearing we will provide for this service will take about 120 per cent of the weight. We provide 120 per cent thrust capacity measured against the radial capacity of the bearing. We do not have any more exact information than this. Probably the reason why thrust plates on engine trucks and drivers give so much trouble is because they are radial plates and centrifugal force throws out the lubrication so that after a few miles they have dry surfaces operating against each other at high speed. Even if the unit pressure is not high the development of heat is high enough to develop the heat checks observed on engine trucks. On the driver bearing or the engine-truck bearing, the thrust reaction on the roller bearings is taken entirely on the roller surfaces.

Question: The statement was made that the cost of one failure of a standard journal bearing or one hot box would cover the cost of equipping a car with roller bearings. If I understood correctly, the speaker made the statement that the cost of installation of roller bearings would be about 10 per cent of the cost of the car. Does he mean 10 per cent of the cost of reproduction new, or 10 per cent of the original value of the car?

Answer: We have been trying to find out what the actual cost of a hot box amounts to. We arrived finally at a figure of $25 per hot box. We have had figures all the way from $5 to $200 per hot box. An analysis of what happens when a hot box takes place would be interesting. We have first the stoppage of the train and the traffic behind it, the crew going back to examine the train and see what happened and how serious it is; then going ahead at slow speed to a set-off track; then coupling up the train and going on. We have the shop operation and the cost of making repairs to the car and getting it into a shop where complete repairs may be made, where that involves the application of a new axle. Anything from $10 to $200 may be involved and if we assume $25 as a fair average that would pay the interest charges on the additional cost of applying roller bearings to a freight car. The problem we set up for ourselves is the application of roller bearings to a 50-ton freight car at a cost not to exceed $300. From what we know of the subject, if we can obtain this result and sell the necessary equipment at a price not to exceed $300, the use of roller bearings on freight train equipment would be justified. If one hot box per year per car were eliminated it would pay the interest and obsolescence on the equipment cost.

It would also permit higher speeds; it would reduce car-body roll because the lateral motion of a roller bearing housing is against a fixed resistance and the tendency is to counteract the free rolling of the car body, whereas the lateral resistance of a plain bearing is zero. That encourages the development of car-body roll and leads to more severe blows on the rail. The experience we have had, involving over 100 cars, indicates that the roller bearing will reduce considerably the severity of car-body roll.

Another point is that freight must be moved at high speed. The automotive industry is engaged in the development of power application to five-ton truck equipment on pneumatic tires that will develop 150 to 175 hp. and move freight along the highways at passenger automobile speed, around 50 to 55 miles an hour. That is going to cost more money than railroad freight movement but it reduces tremendously the cost of doing business in an industrial establishment. It reduces the inventory item in a factory as much as two or three million dollars. I am convinced that the day of high speed freight is coming; that the economy effected in manufacturing the products of commerce will justify the cost of high-speed freight. The railroads must meet this competition of the motor truck. Experience with the roller-bearing locomotive in handling some 80,000,000 ton-miles developed this: That the average speed between terminals is 86 per cent higher than the average railroad speed of 12½ to 13 m.p.h. That average speed developed a certain number of miles per hot box. The average behind the Timken locomotive at the higher speed is 92 per cent more hot boxes in the train. This indicates that higher speeds must be paid for in more frequent hot boxes. The answer is a better plain bearing or a roller bearing. We think that a cost of $300 per car is entirely justified—this does not take into consideration the cost of the truck side frame because that would have to be changed anyway to comply with the new regulations of the A. R. A.

Locomotives Ordered In 1930

(*Continued from page 71*)

plant capacity and car weights, shown in Tables VI and VII, indicates no recession in the trend toward more power and greater weight. In 1928, 27 per cent of the motor cars ordered for service in the United States and Canada had power plants exceeding 350 hp. in capacity. In 1929 over 76 per cent of the cars had

Table VII—Comparison of Rail Motor Weights, U. S. and Canada

Weights	1925	1926	1927	1928	1929	1930
25,000 and under	6	7	..	3	3	..
Over 25,000 lb. to and including 50,000 lb.	19	7	..	4	6	..
Over 50,000 lb. to and including 75,000 lb.	74	2	4	4	..	2
Over 75,000 lb. to and including 100,000 lb.	27	79	29	16	5	..
Over 100,000 lb. to and including 125,000 lb.	7	32	88	62	20	2
Over 125,000 lb. to and including 150,000 lb.	..	5	21	58	54	29
Over 150,000 lb. to and including 175,000 lb.	..	..	..	11	24	13
Over 175,000 lb.	..	1	..	..	7	..
Unclassified	..	..	26	5	13	7

power plants rated at over 350 hp. Last year 42 of the 56 cars ordered, or 75 per cent of the total, were rated at over 350 hp., and 17 of the 42 were rated at over 500 hp. The weights of 29 of the cars fell between 125,000 and 150,000 lb. and of 13 of the cars between 150,000 and 175,000 lb. All of the cars ordered for public service railways in the United States and Canada are equipped with either gas-electric or oil-electric power plants. In the United States an order for one oil-electric car was placed by the Great Northern and in Canada orders for six were placed by the Canadian National.

Small Number of Cars Ordered in 1930

Total orders for freight and passenger cars the lowest since 1921 — Orders for gondola and box cars continue to dominate types of freight equipment ordered—28 per cent of passenger cars ordered are "through-train" equipment

THE total orders for freight and passenger cars placed during 1930 with builders in the United States and Canada were the lowest since 1921. Only 46,360 freight cars were ordered last year for service in this country and only 1,936 for service in Canada. This figure of Canadian orders, as shown in Table I, is one of the six lowest Canadian totals of the past 13 years. The domestic total for 1930 is less than half that of 1929 and is one of the three lowest in the past 30 years.

Only 667 passenger cars were ordered last year for service in the United States and 203 for service in Canada, a total of 870 for both countries. As shown in Table II, the 1930 domestic orders for passenger equipment, exclusive of rail-motor cars and trailers, were slightly over one-fourth of the 1929 total, about 29 per cent. On the other hand, the Canadian total of 203 compares favorably with previous years.

Table I—Orders for Freight Cars Since 1918

Year	Domestic	Canadian	Export	Total
1918	114,113	9,657	53,547	177,317
1919	22,062	3,837	3,994	29,893
1920	84,207	12,406	9,056	105,669
1921	23,346	30	4,982	28,358
1922	180,154	746	1,072	181,972
1923	94,471	8,685	396	103,552
1924	143,728	1,867	4,017	149,612
1925	92,816	642	2,138	95,596
1926	67,029	1,495	1,971	70,495
1927	72,006	2,133	646	74,785
1928	51,200	8,901	2,530	62,631
1929	111,218	9,899	3,023	124,140
1930	46,360	1,936	1,200	49,496

As a whole, the number of passenger cars ordered reflects not only the current general business depression, but the continued loss of passenger business to unregulated competing forms of transportation. These two factors combined forced a drastic curtailment in the buying of this class of equipment, with the result that 1930 ranks fourth as the poorest year in this respect since 1901.

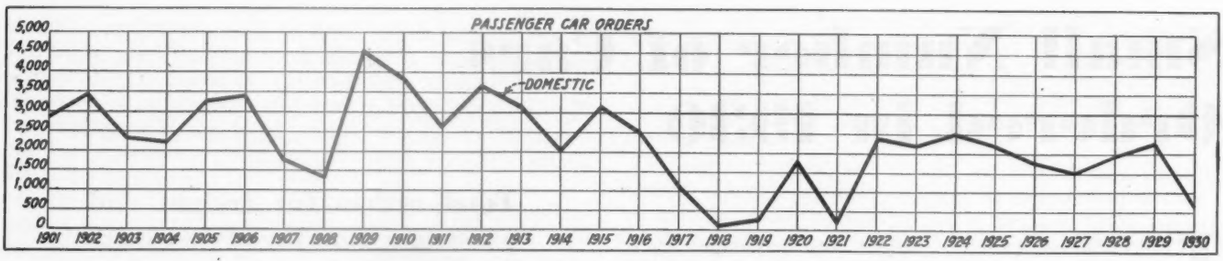
Freight Car Orders in 1930

Table III shows the number of freight cars ordered in 1930 for use in the United States and Canada classified according to type. Of a total of 48,296 freight cars ordered, 10,828 or 22.4 per cent were gondola cars and 13,248 or 27.4 per cent were box cars. A total of 121,117 freight cars were ordered in 1929. Of this total figure, 18,810 or 15.5 per cent were gondola cars and 47,617 or 39.3 per cent were box cars.

The business depression and its effect on railway traffic and earnings, and increased highway and waterway competition is undoubtedly the primary cause for the abnormally low number of freight cars ordered last year. The traffic decline, commencing in October, 1929, has continued unarrested throughout 1930 until carloadings have reached their lowest totals since 1922. Likewise railway earnings have declined sharply and thus a drastic curtailment of equipment purchases was not an unexpected development.

In the forefront among 1930 freight car buyers were

Pittsburgh, Shawmut & Northern 40-ton single-sheathed box car built by the Mather Stock Car Company



Passenger car orders from 1901 to 1930

the Van Sweringen lines. These roads purchased 13,754 cars or more than one-quarter of the year's total. Of the 13,754, the Chesapeake & Ohio ordered 6,504, the Pere Marquette, 4,875 and the Erie, 2,375. Other large purchasers were: Chicago, Milwaukee, St. Paul & Pacific, 2,812; Baltimore & Ohio, 2,002 and Seaboard Air Line, 2,000. Of the Canadian cars ordered, the Canadian National purchased 781 and the Canadian Pacific 1,155.

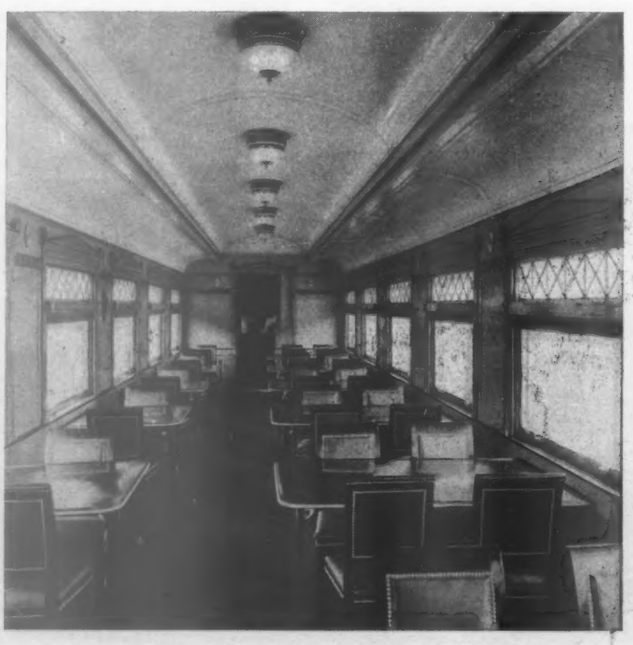
Of interest in connection with the designs of freight cars ordered last year are the large number built to A. R. A. standard dimensions and designs. An analysis of the freight cars ordered during the past three years shows that the work done by the A.R.A. Mechanical Division is beginning to bear fruit. This is especially noticeable with respect to single- and double-sheathed box cars, for which standard designs were first adopted.

Table II—Orders for Passenger Cars Since 1918

Year	Domestic	Canadian	Export	Total
1918	9	22	26	57
1919	292	347	143	782
1920	1,781	275	38	2,094
1921	246	91	155	492
1922	2,382	87	19	2,488
1923	2,214	263	6	2,483
1924	2,554	100	25	2,679
1925	2,191	50	76	2,317
1926	1,868	236	58	2,162
1927	1,612	143	48	1,803
1928	1,930	334	29	2,293
1929	2,303	122	33	2,458
1930	667	203	15	885

Of further interest is the increase in the number of 65-ft. mill-type gondola cars for which there appears to be an increasing demand. Of the freight cars ordered last year, 1,775 cars or 3.5 per cent, were of this type. The Pennsylvania ordered 1,700 gondola cars having a length of 65 ft. 6 in., which were built in its own shops.

Table IV shows the freight-car production totals for each year since 1913. These figures should not be compared with the totals of orders placed. The production figures show the number of cars actually built during the year and, of course, includes cars ordered the preceding year.



Atchison, Topeka & Santa Fe dining car equipped for conditioning the air. Built by Pullman

Passenger-Car Orders in 1930

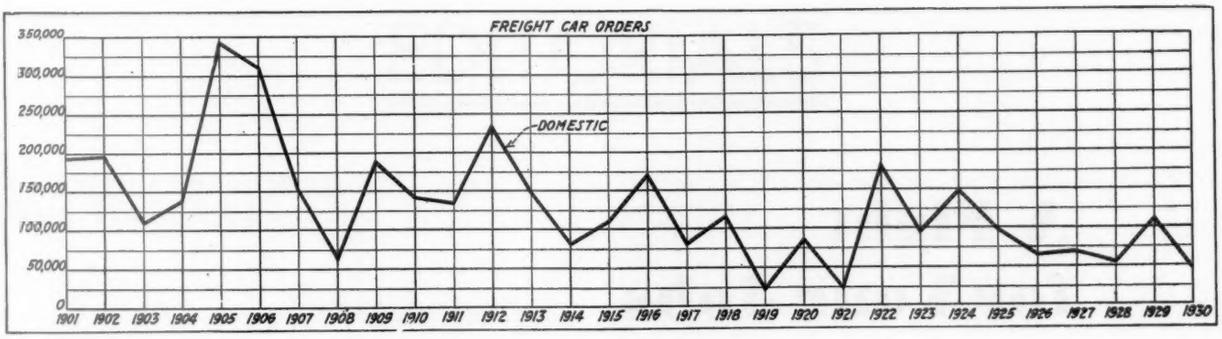
Table V shows the types of passenger equipment ordered during the past four years. Included in this table are the orders for rail-motor cars and rail-motor car trailers, two types which were not considered when making the compilations for this table previous to this year. An analysis of the characteristics of the rail-motor equipment ordered in 1930 is included in the article reviewing last year's orders for locomotives, elsewhere in this issue.

Table III—Types of Freight Cars Ordered in 1930 for Use in the United States and Canada

Type	Number	Per cent
F—Flat and logging	2,159	4.5
G—Gondola	10,828	22.4
H—Hopper	5,248	10.8
R—Refrigerator	6,890	14.4
S—Stock and Poultry	980	2.0
T—Tank	3,623	7.6
X—Box	13,248	27.4
Automobile	4,364	9.0
Ballast, dump and ore	448	.9
Not classified	297	.6
N—Caboose	211	.4
Total	48,296	100.0

Twenty-eight per cent of the passenger cars ordered in 1930 were sleeping, parlor, chair and other special types designed primarily for service on through trains. A total of 227 cars ordered, or 26 per cent, were for day-coach service. An interesting comparison with preceding years are the orders for baggage, express and mail cars. For the three years previous to 1930, orders for this type of equipment were next to the largest number in the types ordered. Last year, the total of 131, or 15 per cent of the total, placed this type of passenger equipment fourth with respect to the number of cars ordered. Orders for rail-motor equipment were omitted in calculating the percentage figures.

The year's largest group of orders was placed by three Van Sweringen lines, as in the case of freight cars and locomotives. The orders were for a total of 131 cars—71 for the Chesapeake & Ohio, 40 for the Erie and 20 for the Pere Marquette. The other principal buyers



Freight car orders from 1901 to 1930

were the Pullman Company, 94, including 60 sleeping cars; the Reading, 80, including 70 multiple-unit cars; the New York Central, 50 milk and 10 dining cars, and the Long Island, 45 multiple-unit cars.

The number of passenger train cars built during 1930 for domestic service in the United States was 1,264, as shown in Table VI, almost the same as the production figure for 1929, but slightly below the corresponding totals for other years since 1922. Construction of 40 passenger cars for export from this country doubled the 1929 export production figure of 20 cars; while Canadian production, of cars for use in Canada, totaled 210, and exceeded by a wide margin the 162 cars built for the same purpose in 1929. As in the case of other equipment statistics, it is necessary to bear in mind the difference between figures showing cars ordered and those showing cars built.

Table IV—Freight Cars Built Each Year Since 1913

	United States			Canadian			
Year	Domestic	Foreign	Total	Domestic	Foreign	Total	Grand total
1913	176,049	9,618	185,667	22,017	....	22,017	207,684
1914	97,626	462	98,088	6,453	....	6,453	104,451
1915	58,226	11,916	70,142	1,758	2,212	3,970	74,112
1916	111,516	17,905	129,421	....	....	5,580	135,001
1917	115,705	23,938	139,643	3,658	8,100	11,758	151,401
1918	67,063	40,981	108,044	14,704	1,960	16,664	124,708
1919	94,981	61,783	156,764	6,391	30	6,421	163,185
1920	60,955	14,480	75,435	....	....	....	....
1921	40,292	6,412	46,704	8,404	745	9,149	55,853
1922	66,289	1,126	67,415	458	100	558	67,973
1923	175,748	2,418	178,166	....	....	....	....
1924	113,761	1,141	114,902	1,721	....	1,721	116,623
1925	105,935	3,010	108,945	....	....	....	....
1926	88,862	2,771	91,633	1,645	....	1,645	93,278
1927	63,390	1,087	64,477	2,851	....	2,851	67,328
1928	46,060	938	46,998	5,158	....	5,158	52,156
1929	82,240	3,168	85,408	8,557	....	8,557	93,965
1930	75,188	1,909	77,097	6,923	....	6,923	84,020

Table V—Types of Passenger Equipment Ordered for Use in the United States and Canada

Type	1927	1928	1929	1930
Coach, combination passenger, etc.	760	553	382	227
Sleeping, parlor, chair, etc.	238	322	654	246
Dining	111	123	111	48
Baggage, express, mail	422	502	506	131
Express-refrigerator	2	30	505	0
Milk	45	600	30	50
Horse	17	49	40	10
Private, business, miscellaneous	108	55	37	1
Multiple-unit coaches and trailers	52	30	160	157
Rail-motor cars	164	163	132	53
Rail-motor-car trailers	25	22	21	9
Total	1,944	2,449	2,578	932

Table VI—Passenger Cars Built Each Year Since 1913

	United States				
Year	Domestic	Foreign	Total	Canadian Domestic	Grand total
1913	2,559	220	2,779	517	3,296
1914	3,310	56	3,366	325	3,691
1915	1,852	14	1,866	83	1,949
1916	1,732	70	1,802	37	1,839
1917	1,924	31	1,955	45	2,000
1918	1,480	92	1,572	1	1,503
1919	306	85	391	160	551
1920	1,272	168	1,440	....	....
1921	1,275	39	1,314	361	1,675
1922	676	144	820	71	891
1923	1,507	29	1,536	....	....
1924	2,150	63	2,213	167	2,380
1925	2,363	50	2,413	....	....
1926	2,184	102	2,286	285	2,571
1927	1,785	50	1,835	126	1,961
1928	1,356	15	1,371	237	1,608
1929	1,254	20	1,274	162	1,436
1930	1,264	40	1,304	210	1,514

NAMES ON BRITISH LOCOMOTIVES.—When James I was made King of England about 1603, he brought with him from Scotland his much admired court jeweler, George Heriot, whom he familiarly nicknamed "Jingling Geordie," a sly reference to his wealth. Now, the London & North Eastern has named a locomotive in honor of George Heriot, who bequeathed the bulk of his fortune to the magistrates and clergy of Edinburgh, Scotland. The locomotive is a superheated "Scott," Class 4-4-0, No. 9421, and was built at Cowlairs in 1914. The name "Jingling Geordie" is painted on its side. There is also a Pacific type locomotive on the same road, No. 2751, called the "Humorist."—N. Y. C. Magazine.

Baltimore & Ohio 70-ton, 65-ft. mill-type gondola car with Duryea cushion underframe—Built by Bethlehem Steel Company

A Fight for Your Jobs

THE Association of Railway Executives at a meeting at New York on November 20 formulated a definite program of proposals which the railroads will unitedly push in order to cope with the unfavorable state of railway earnings and traffic. This program is of vital interest to all railway employees. The future security of their jobs depends upon the success with which these proposals for changes in the attitude of public regulatory bodies and of the public toward the railroads and competing transportation agencies are carried into effect.

The Program

The program formulated for the railways by the Association of Railway Executives is as follows:

1—A respite from rate reductions and suspensions by regulating bodies, both intra and interstate, and from action that will increase the expenses of the carriers.

2—A respite from legislative efforts of either the national or the State legislatures that would adversely affect rates or increase the expenses of the carriers.

3—A withdrawal of governmental competition both through direct operation of transportation facilities, as well as indirectly through subsidies.

4—A fairly comparable system of regulation for competing transportation service by water and on the highways, involving affirmative legislative action as follows:

As regards water transportation, legislation should cover.

A—Extending jurisdiction of the Interstate Commerce Commission over port to port rates, to include—

B—Determination of just and reasonable rates, and prohibition of discriminatory and unduly prejudicial rates.

C—Publication of and adherence to rate schedules.

D—Proper service requirements.

E—Certificates of public convenience and necessity after proper showing.

F—Opportunity for railways to enter this field of transportation under proper supervision, but without handicap as compared with other transportation agencies. The Panama Canal Act should be modified so as to permit railroad operation of waterway service in conjunction with rail service.

G—And, in addition to affirmative legislative action, the retention of the flexible character of section 4, Interstate Commerce Act, sympathetically administered, with fair opportunity on the part of rail carriers to obtain relief after proper showing and including transcontinental traffic.

As regards commercial highway transportation, by bus or truck, legislation should cover—

A—Extending jurisdiction of the regulatory authorities over commerce carried by such agencies.

B—Certificates of public convenience and necessity after proper showing.

C—Proper protective requirements for financial responsibility and surety bonds or insurance.

D—Adequate requirements for just and reasonable rates, both maximum and minimum, with provision for publication thereot and adherence thereto, and proper inhibition against undue and unjust discrimination.

E—Proper service requirements.

F—Adequate authority for rail carriers to operate such facilities, without discrimination in favor of other transportation agencies in the same field.

G—Adequate provision for privilege or license fee imposed on all motor vehicles for hire or profit using highways, so as properly to participate in construction and maintenance costs of highways.

That the program of the railroads is not a blindly selfish or unfair attempt to better their own situation at the expense of the public is clearly indicated by the following paragraph from the executives' statement:

"In so far as any form of the above service is legitimate, and a natural economic development, the railroads have no right to complain. The public is entitled to the best transportation at the lowest reasonable cost. However, where the rail carriers are prevented through legislation or regulation from fairly competing with new or old forms of transportation, or where the service rendered by the competitor is a subsidized one, such unfair handicaps should be removed."

In order that our readers may acquaint themselves with the facts pertaining to the situation which the railroads are facing and determine for themselves whether or not the program of the executives is fair, various phases of this situation will be discussed on this page in future issues.

The fight of the executives for fair treatment is no more in the interest of the corporate welfare of the railway companies than it is in the interest of the employees. The future of both depends upon healthy conditions in and affecting the industry. Let every employee inform himself and join in the fight for a square deal for the railways!

EDITORIALS

An Enginehouse Staff With Three Objectives

The first of last year the enginehouse staff of one railroad set three objectives to be achieved during the year. The first was cleanliness and good housekeeping, the second, to decrease engine failures, and third, reduce expenses.

With respect to the first objective, we quote direct from a report for the month of November: "From the inspections made this month, there is no question but what everyone of the shops and engine terminals were in a very neat, clean and orderly condition. Now what must be done is to keep them in that condition. A place for everything and everything in its place."

As to decreasing engine failures, a comparison of the actual number of failures during the month of October with those of January, shows a decrease of over 44 per cent. The percentage of defective locomotives reported by federal inspectors was reduced from a maximum of 39 per cent to 8 per cent.

Naturally, the third objective, to reduce expenses, was to keep the expenditures of the motive power department in line with the reduced income of the railroad which all railroads are experiencing at the present time. The economies effected thus far were accomplished, as evidenced in many respects by the results of the first two objectives, without seriously impairing the efficiency of engine terminal operations. The stressing of these three objectives has affected economies in practically all of the other terminal operations. Give a man a clean and orderly place in which to work and the management can accomplish wonders.

Lubrication Research Needed

It is apparent that the work of the A. R. A. Committee on the Lubrication of Cars and Locomotives has about reached the point where laboratory research and investigation is needed. Its work thus far has been exceedingly fruitful. Four years ago the average car-department officer thought his road was getting wonderful results if it produced a record of 20,000 freight-car-miles per hot box and one million passenger-car-miles per hot box. Today, he is unhappy unless he is approaching 50,000 freight-car miles and over two million passenger-car-miles per hot box. One road in the east recently attained a record of over 200,000 miles per hot box on freight cars.

Considerable of what has been accomplished can be credited to the adoption of A.R.A. Rule 66. Thus far this rule has been an important factor in improving the hot-box situation. However, there are a number of mechanical-department officers who believe that Rule 66 can be made more effective if it includes a provision whereby bills can be refused for repacked boxes which must be packed again within sixty days.

To date, the work done by the committee has been entirely of a practical nature. It has made recommendations for the renovation of packing to meet A.R.A. requirements. It has formulated rules pertaining to the correct packing of journal boxes and has outlined a procedure for the instruction of box packers. It has made an intensive study of the causes of hot boxes and is now investigating the possibilities of an all-year oil as a substitute for the winter and summer oils which the majority of railroads are now using.

Several producers of lubricating products have undertaken, or are contemplating, a series of laboratory studies of car lubrication. These tests will be of value to the industry and the results will be of considerable assistance to the Lubrication Committee. However, an accurate knowledge of the part mechanical defects play in causing hot boxes is undoubtedly of as great importance from the standpoint of the railroads as a knowledge of the lubricating characteristics of various oils under varying operating conditions.

There is no reason why a testing machine cannot be designed on which a variety of mechanical defects can be set up for laboratory investigation. Such an investigation, supplemented by the oil tests being contemplated, together with such data as have already been assembled by th A.S.M.E. Special Research Committee on Lubrication and by a number of other technical societies, should be of material assistance in continuing the improvement of journal-box conditions.

Engine Failures Due to Faulty Material

The number of locomotive-miles operated per engine failure is an index of mechanical department efficiency watched with the keenest interest by mechanical and operating department officers on all roads. Generally speaking, locomotive performances in this particular are now being secured which would have been considered impossible a few years ago. Engine failures still occur, however, and the embarassing nature of engine failures is familiar to every locomotive department officer. How they dread to see an epidemic get started of failures in one particular detail! For weeks, and sometimes months, after the correction of the original difficulty, engine crews and operating department forces avidly seize upon the opportunity to blame every possible delay caused by their own deficiencies against that particular locomotive defect.

Material failures are, of course, generally due to the use of incorrect materials, materials improperly made, or those used in such a way as to constitute abuse. Some highly pertinent comments regarding this subject were contained in a paper presented by Dr. William M. Barr, consulting chemist, Union Pacific, before the Pacific Railway Club early in 1930. Doctor Barr stressed the necessity of strictly following specifications in the replacement of worn-out or broken parts, in order to avoid the failure of steel parts, for example, which may give every appearance of duplicating the original part, but, in reality, do not have the requisite physical characteristics.

The necessity of careful handling of steel or locomotive parts in all phases of their manufacture and fabri-

cation can hardly be overemphasized. Doctor Barr calls attention to a number of specific instances in which such care was not exercised. A few of these include a forging of correct chemical composition, but with a serious internal rupture, developed during the process of manufacture; a crank pin, unsound, due to being made from steel cut too close to the top of the ingot; a broken driving rod, due to a progressive fracture, developed from an internal structural defect; rod failures from progressive fractures, due to sharp fillets, rough cuts or surface imperfections caused by mishandling; flue sheets cracked, due to improper practice in flanging; steel castings and forging welded without the proper allowance for expansion and contraction, or giving due consideration to the effects of heat on the internal structure of the metal itself.

Alloy steels are usually considered more "temperamental" than plain carbon steels, but, after acknowledging that structural defects, such as pipes, gas pockets, and segregations, were found in many alloy steels when first offered to the railroads, Doctor Barr paid tribute to the improvements effected by the alloy steel manufacturers in the following words: "It is now possible to get sound forgings, even in the largest sections, as readily as with plain carbon steel."

There is a great need for further earnest and intelligent study of the characteristics and limitations of all kinds of steels by railroad men in order that this basic material may be used, not blindly, but with maximum efficiency in the service of the railroads and the country at large.

Cleaning Freight Cars Is a Real Problem

The cleaning of freight cars and putting them in condition for the satisfactory transportation of high-class, as well as lower-grade, commodities constitutes a real problem. It is an item of expense of no mean proportions, even after the installation of adequate cleaning facilities, which, for the best results, should comprise cleaning tracks fully equipped with air, steam, water and drainage lines. The initial cost of this equipment may well amount to several thousands of dollars for a relatively small installation, considering both labor and material costs, including the expense of carefully lagging steam lines to save fuel, and water lines to avoid freezing in cold weather.

Unquestionably, railroads are called upon to perform more extensive car-cleaning operations at greater expense now than ever before. Car-department officrs state than an ever-increasing number of shippers are becoming over-technical and are refusing cars which would have been accepted as meeting the requirements of their particular commodities a few years ago. Railroads generally recognize their responsibility for furnishing cars clean and in good condition to handle each class of commodity without resultant damage or taint. They should not be expected, however, to furnish cars of a higher grade than required, particularly when commodities such as hides, oils, greases, etc., are to be loaded. Not only does this necessitate a lengthy and expensive cleaning operation, but sometimes the equipment is put permanently out of commission for subsequent high-class loading, with resultant substantial loss to the railroad.

In general, the railroads provide three classes of car-cleaning operations, the first of which includes sweeping out and blowing with air, accompanied by the removal of loading blocks, wires, nails, etc. The second class covers all the work performed in the first, with the addition of washing out with cold water. The third class is the same as the second, with the exception that the car is washed with hot water and steam, using a cleaning compound and disinfectant when necessary. Inasmuch as it is good economy to clean freight cars always with a view to returning them to as high-class service as possible, the problem of removing oil and grease spots from floors and inside linings is an important one, and considerable pertinent information regarding this phrase of car cleaning is provided by F. J. Swanson, district master car builder of the Chicago, Milwaukee, St. Paul & Pacific, in a recent paper before the Chicago Car Foremen's Association, abstracted elsewhere in this issue.

The relative merits of different methods for eradicating grease or oil spots, as mentioned in the paper, are more or less in dispute and, judging from the discussions at conventions and elsewhere, it is apparent that an entirely satisfactory way of removing oil spots has not yet been developed. The burning process is not always applicable, but it would appear from Mr. Swanson's paper that it is practical in the majority of cases, provided proper care is exercised by the operators of the flame. The fact that cars cleaned by this process are satisfactory to the flour shippers of Minneapolis is significant, as flour is more susceptible to contamination from oil that almost any other commodity. Therefore, the information in Mr. Swanson's paper should lead to additional experiments along the same lines.

An essential feature of any car-cleaning operation is the cost per car. Many of the diversified figures quoted by railroad men are so far out of line as to justify the assumption that all details of cost are not taken into consideration in every instance. If some semblance of uniformity could be established to serve as a guide in arriving at the actual cost, it would, no doubt, prove beneficial in making comparisons and promote the increased use of the most economical and effective method.

What Is Reclamation?

A recent report on the reclamation activities on a certain road contained the following two paragraphs: "During the year our valve repair shop reclaimed 2,120 angle cocks, 2,587 cut-out cocks of various sizes, 981 drain cocks, 36 stop cocks, 5,701 globe valves, * * * * The tin shop takes all old —— roofing that is received from the entire railroad and uses it in the manufacture of fire buckets, mileage marker signs, metal flags, signs, smoke jacks, stove pipes, etc. In this building we repair switch lamps, train-order lamps, in fact all classes of lanterns and tinware. Pipe fittings are reclaimed. Flexible joints, shovels, track gages, post-hole diggers, stove castings, etc., are placed in first-class condition and returned to stock." Another part of the report stated that coupler rivets were made out of old 1⅛-in. beam truss rods and that all coupler yokes are made out of scrap material.

The above statements, selected at random from the report, characterize three things that may be questioned in connection with reclamation as the practice is viewed on some railroads—the fact that some reclamation operations are actually manufacturing, that others indicate the segregation under another roof or department of normal

shop repair work and that the reclamation idea is carried so far as to be of questionable value.

In an editorial in the *Railway Mechanical Engineer* a short time ago reference was made to a case where one road had issued orders to hold up reclamation on many items until an investigation could be made of the actual cost of the work and the savings, if any, that might be expected. Since that time other cases have come to our attention where the reclamation plant is being viewed more critically than it was when actual savings were less important than they are under present conditions. The railroads have been criticized in many cases for entrance into the manufacturing field and it would seem highly desirable to make careful cost analyses to determine whether or not the manufacturing of parts or utensils from scrap material in a reclamation plant is justified. There would seem to be some question whether or not such items as fire buckets, metal signs or stove pipes could be made of any kind of material as cheaply as they could be purchased. Then again what about quality and serviceability?

An analysis of the report in question revealed the fact that a great part of the work being performed in the reclamation plant was actually nothing more nor less than normal repair work performed day in and day out in any railroad shop. Why take it out of the shop and put it in the reclamation plant? Possibly the normal major repair operations of any shop could be materially improved if this kind of work were taken out of the departmental groups and placed in another department with special machines and trained men to do the work. But why call it reclamation?

The manufacture of coupler yokes and coupler-yoke rivets out of scrap materials would seem to be a most extravagant kind of economy. Metals sooner or later reach a limit of economic usefulness, for fatigue so changes their physical structure as seriously to affect their ability to withstand stresses. The draft gear on any car or locomotive in main-line service is an extremely important unit and one or two train delays from pulled-out drawheads can wipe out any savings effected by using scrap material instead of new.

The entire problem of reclamation is worthy of careful consideration from a mechanical department standpoint. In many cases extravagant claims are made as to the savings that are effected by reclamation but investigation often reveals that the savings are more theoretical than actual. In any event the mechanical department pays the bills in the long run.

Power for Heating and Cooling Passenger Cars

In an article elsewhere in this issue which discusses the basic requirements for cooling and conditioning the air for railway passenger cars, the author compares the requirements for heating and cooling passenger cars in terms of horsepower. His statement would make it appear that from seven to ten times as much power is required to heat a train under the most severe winter weather conditions as is required for the effective cooling of a dining or sleeping car in severely hot summer weather. The figures used are 100 hp. for heating and 10 to 13 hp. input for the refrigerating plant for cooling.

Considered on a thermal-unit basis, the 100 hp. for heating represents approximately the requirements for a passenger coach with a difference of temperature inside and out from 70 to 75 deg. Since the amount of heat transferred from the steam supplied to the car is well over 1,000 B.t.u. per pound, it requires but little more than two pounds of steam to supply the car with the heat-unit equivalent of one horsepower. It is evident, therefore, that the steam required to heat a passenger coach represents but a fraction of 100 hp., delivered at the drawbar.

Tests indicated that the modern steel passenger car can be heated with about 2.85 lb. of steam per hour per degree difference of internal and external temperature. With an assumed temperature difference of 75 deg., a 15-car train would require about 3,200 lb. of steam per hour. As many passenger locomotives will produce a maximum of 40,000 or more pounds of steam per hour, the maximum steam-heat load of a 15-car train represents hardly more than 8 per cent of the locomotive boiler capacity. There would appear to be no great difference in the load on the locomotive required for heating or for cooling passenger cars, respectively under severe winter and summer weather conditions. The exact relationship will, of course, depend somewhat on the efficiency with which energy is converted into mechanical work at the car refrigerating plant.

NEW BOOKS

BOOK OF A.S.T.M. STANDARDS. *Published by the American Society for Testing Materials, 1315 Spruce street, Philadelphia, Pa. Two parts. Bound in cloth, $14; bound in half leather, $17.*

The 1930 edition of the Book of A.S.T.M. Standards, which is issued trienially, is in two parts, Part I of 1,000 pages containing 179 standards adopted by the society relating to metals, and Part II of 1,250 pages containing 251 standards adopted by the society relating to non-metallic materials. The 1930 edition of the Book of Tentative Standards, published annually, contains 155 tentative standards in effect at this time, and can be obtained for $7, paper bound, or $8, cloth bound. The standards are grouped according to the materials to which they apply.

PROCEEDINGS OF THE INTERNATIONAL RAILWAY FUEL ASSOCIATION. *Published by the International Railway Fuel Association, 700 La Salle Street Station, Chicago. 568 pages, illustrated. 6 in. by 9 in. Flexible red-leather binding.*

The proceedings of the 1930 convention of the International Railway Association, which was held at Chicago May 6 to 9, indexes reports on Steam Turbine Locomotives; Diesel Locomotives; Front Ends, Grates and Ashpans; New Locomotive Economy Devices; Locomotive Firing Practice, both oil and coal; Inspection and preparation of fuel; fuel Conservation Bulletins and Cartoons; Fuel Distribution and Statistics; Classification of Coal; Storage of Coal and Oil; Locomotive Fuel Stations, and Stationary Boiler Plants, both coal and oil. The addresses presented at this convention were by W. J. Tapp, fuel supervisor, D. & R.G.W.; J. S. Pyeatt, president, D. & R.G.W.; Samuel O. Dunn, editor, Railway Age; C. E. Bockus, president, National Coal Association; F. H. Hardin, assistant to president, N.Y.C., and R. E. Woodruff, vice-president, Erie. Papers were presented also by H. N. Rodenbaugh, vice-president, F.E.C., whose topic was "Should the Railways Expect Decreased Fuel Costs?"; D. L. Forsythe, St. L.-S. F., who discussed "Locomotive Operation in Extended Service", and J. C. Nolan, Gulf Coast Lines, who discussed "Lignite Coal".

THE READER'S PAGE

A Question On Rule 17

To the Editor:

Rule 17, Section (c) protects the size of coupler butt. The equipment on one of A's cars includes a coupler with a 5-in. by 5-in. shank and an 8½-in. butt and is so stenciled on both ends of car. B applies an A.R.A. Type D coupler with a 5-in. by 5-in. shank and a 9⅛-in. butt as existing arrangements of sills and drafts are suitable. Does B make wrong repairs because he applies a coupler with a 9⅛-in. butt instead of the one with an 8½-in. butt which is standard on the car in question?

J. A. Garner.

A Bit of Warmth In a Cold Winter

To the Editor:

We have got to hand it to the sales engineers, fourteen of whom have called on me already this year, each one appearing with the same glad old spirit of prosperous days, looking and acting as though business was never better. In conversation, all declared that better times are just around the corner and refused to listen to all tales of gloom.

While one has a job that will at least buy bread and butter for himself and the kids, some of these "heroes" of the road when pressed for actual facts will acknowledge, if they are real intimate acquaintances, they haven't booked an order for five months. Therefore, I say, let us try and find time for a little cheerio visit when they call and, even if not in the market for anything, take time to tell them so in a courteous manner, for these boys can surely do with a little extra friendliness at this time.

If you have never done so before, start now and invite one over to the house for lunch, or to spend an evening once in a while. It won't cost much, but will make a heck of a difference to some good chap's outlook.

Shop Superintendent.

How to Detect Loose Wheels

To the Editor:

I note, in your January number, that the loose wheel has again bobbed up. In the case of an indication of possible looseness, it is necessary to establish beyond doubt that the wheel is not loose, or the car must, in the interest of safety, be set out. The quickest and easiest way to determine this is to examine the junction of the hub and the axle at the back of the wheel for indications that the wheel has moved on the axle seat. If there is an unbroken binding film between the wheel and the axle, it is a sure indication that the wheel is not loose, notwithstanding that there may be oil seepage indications on the back of the hub. As a matter of fact, oil seepage is of rather frequent occurrence, usually due to small grooves ploughed into the surface of the wheel seat during the pressing-on process.

Since a binding film is so important in such cases, it is also important that no pressed-on wheels leave the wheel shop without such a paint film. If a sufficient amount of the paint has not been pushed ahead during the pressing-on process to produce a good binding film, the deficiency should be remedied by applying the paint film by brush or otherwise.

In the case of chilled iron wheels, this paint film will ordinarily last from pressing to pressing. If, however, the wheels are shopped for other than press work, the back of the fit should be examined, and if there is not present a clearly-defined film, paint should be applied to form one.

In the case of multiple-wear steel wheels, however, the film will ordinarily have been destroyed by weather, abrasive action of sand, cinders, etc., long before the wheels are due for pressing off. Thus, on such wheels there may be some doubt as to their being loose, particularly with the presence of brown rust stains at the back of the fit, more or less peculiar to this type of wheel.

An excellent practice is to apply a new paint film at the back of the fit, when wheels come to the shop for turning or other work, this, of course, after proper inspection to establish the fact that the wheel is not loose.

Assistant Master Car Builder.

A Rational Reclamation Program

To the Editor:

The editorial, "Does It Pay To Reclaim?" published in the September issue of the *Railway Mechanical Engineer,* raises an important question.

During the war period one railroad with which I am familiar went into the reclamation business on a large scale. Reclamation platforms were erected (presumably without thought of the cost) at practically every point where repairs were made to cars or locomotives with the ultimate result that what might be called two distinct storehouses were established—one for new material and one for second-hand or reclaimed material.

The car foreman took delight in piling up reclaimed springs, follower plates and blocks, brake shoes, bolts, rivets and miscellaneous car parts upon platforms. In many cases the bins or platforms required additional bracing every now and then to keep them from giving way under the excess weight. I say they took delight in accumulating this material because they submitted a monthly statement showing the amount of money saved from the scrap pile, minus the actual cost of reclamation. Quite frequently they received commendation from the mechanical department officers for having accumulated so much from the scrap pile.

This material could be drawn out without cost by the car repairer. It was a rule that he must visit the reclamation platform regardless of the piece of material which he desired to obtain. If, by chance, the item was not in stock, a material card was issued by the attendant which authorized withdrawal of new material from the storehouse.

One day the mechanical department on that road woke up. Someone took an inventory of reclaimed stock and it was found that about 75 per cent of it was not moving because it was obsolete. They found that such items as draft-gear and truck springs, coupler yokes, forgings, grab irons, sill steps and many other parts had greater value as scrap than as usable material. Many of the draft gears which they had been saving were solid due to wear and would provide about the same cushioning effect as an ordinary oak block.

The majority of this so-called reclaimed material was consigned to the scrap pile and the business of dismantling the reclamation plant was begun.

We should ask ourselves the following questions: Where did the good rivets, bolts, nuts, washers, safety appliances, etc., which were sent to the reclamation plant for stock, come from? Is it not probable that too many were drawn out of the storehouse for some particular repair job and that those left over had been picked up and sent to the reclaiming platform for stock? Didn't they cost just as much at the reclamation platform as they did at the new material storehouse, even though they were used at a later date? If draft-gear and truck springs, as well as the gears themselves, were worth reclaiming why were they not applied on the particular car from which they were removed at the time it was undergoing repairs?

While it is true that some parts, such as couplers with bent shanks, and other parts which can be straightened and reclaimed at the blacksmith shop should be reclaimed, I believe that the time to reclaim material is not after it is placed in the scrap heap, but at the time it is removed from the car. It should be inspected by a competent inspector and either marked for reapplication or scrapped.

Those parts requiring repairs before they can be used again should be passed on by the foreman in charge of the shop or his appointed representative, who should take into consideration the cost of reclaiming plus the overhead expense and the serviceability of the part after it has been repaired. By adding the scrap value of the item to this total, in many cases it will be found that the total cost will equal or exceed the original or storehouse price of the new part.

E. E. EVANS.

Who Belongs to This Organization?

TO THE EDITOR:

"Which Man Would You Hire?" is asked on page 638 of the November issue. If all foremen's organizations are like one I have become acquainted with, I would unhesitatingly take the "non-joiner", but I feel that perhaps the one herein described is an exception.

A greater amount of self satisfaction and esteem than these fellows possess I have never seen. They meet once a month, or more often, to discuss how clever they are and how poorly managed their railway is. Only two of them subscribe regularly to any trade journal. None is enrolled in any home study course and each appears to be far more interested in comparing how many overtime hours he is called on to work rather than any privileges he may enjoy. If it is discovered that some other railroad pays higher salaries than they receive, they have a subject for discussion at the next several meetings. Should an exceptionally large output be effected some week, they fill up with pride of personal accomplishment, but on the occasion of an admittedly poor one they can immediately prove to their own satisfaction that it was the fault of the stores department or some influence or other entirely outside of their control.

So, I repeat, when you have a man with the desired capacity for a supervisor who refuses to affiliate with that sort of an organization, he would be the most likely one to choose. Would it not be well to ask "A Job Hunter" to describe the kind of a foreman's organization he has in mind?

MASTER MECHANIC.

Are Two Men Ever Alike?

TO THE EDITOR:

A correspondent, on page 638 of the November issue asks, "Which Man Would You Hire?". The statement that "two men with the same qualifications and experience applied" is what leads me to offer my comments for I do not believe it possible that two men could have the same qualifications.

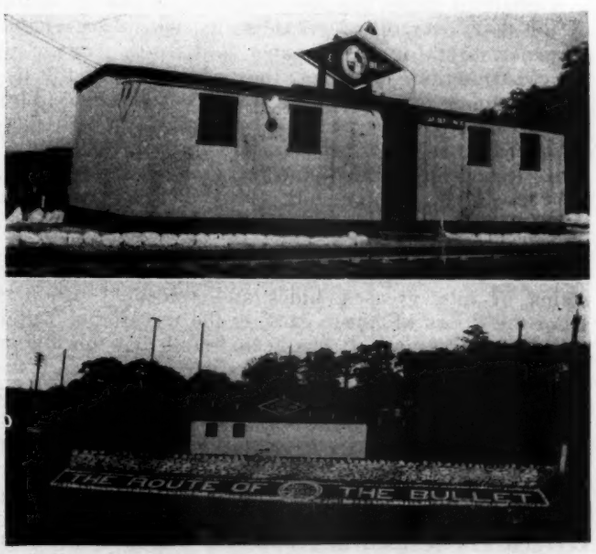
In my twenty-five years of contact with railway shop supervisors, I have never come across two men having qualifications anywhere near similar, and were one a "joiner" or not, there has always been plenty of differences in age, personality, experience, capacity, etc., to enable one to pick the best man. A man may not be a joiner, but by the expenditure of probably five dollars could become one, may be spending for his improvement more than that amount every week.

I would inquire as to his reason for non-membership in an organization that was admittedly functioning for the purpose of training supervisors to become real masters of their present jobs and fit candidates for any promotion that could possibly be offered them. Were it shown to be merely a matter of indifference or that he was sufficiently well pleased with himself without making any extra effort to keep abreast, he most certainly would have a small chance for the vacant job.

I wonder if this answers "Job Hunter's" question?

A JOB HOLDER.

* * *



An effective bit of "way-side" advertising by the employees of the car department. The rip track at Penobscot Yards on the Central of New Jersey

With the Car Foremen and Inspectors

Removing Oil and Grease Spots*

By F. J. Swanson†

MORE or less animal hides, oils and greases are being transported in high-class house cars, resulting in these cars not being fit for high-class loading until cleaned. Several different methods are employed by the railroads in cleaning their cars and removing oils, grease spots, etc.

Good success in removing oil and grease spots in car floors is obtained by using the gasoline blow torch with the flame directed on the spots. Heat causes the oil to come to the top surface of the floor, where it is evaporated and burned. The operator, if fully experienced, can tell when all the oil has been removed. This practice does no damage whatsoever to the car floor as far as burning is concerned. The slightly charred part of the floor is scraped away by the operator by using a metal scraper or wire brush. This is all swept out of the car. When the operation is completed, the car is fit for any high-class lading, such as flour, grain or food products.

Several manufactured products are being used by various railroads for the removal of oil and grease spots, but they are still in the experimental stage. Careful studies and tests should be made or continued in order to solve this phase of the car-cleaning problem.

Some tests have been made of manufactured paints or alcohol paints which have not proved entirely satisfactory, especially when used during sub-zero temperatures when the paints do not seem to dry but become sticky.

Asphaltum paper has also been laid or placed on top of the floor over oil or grease spots, which are unable to penetrate through the paper and cause damage to the car contents. However, the possibilities of the paper becoming torn or missing are considerable. This paper could possibly be used or applied to high-class cars which are used for mixed commodities, such as oils, greases, hides, oiled machinery or oiled sheet steel, thus eliminating the possibility of the grease or oil spots and keeping the car fit for high-class loading when empty.

Much success has been obtained in removing the stains of oils, greases, hides and creosoted products from the floors of house cars by the use of hot water and steam pressure. It has been found that the higher the pressure, the better the operation. The use of superheated steam naturally produces a more dry heat which has a tendency to burn up the oil or grease spots. This also causes softening or thinning out of the oil, the force of the steam pressure assisting in removal of all foreign material from the car.

There are several manufactured products on the market that can be used in connection with hot water or steam. The Milwaukee has used successfully soda ash with steam in removing oils and greases; also caustic soda with steam pressure in removing the trace of green hides and creosote. The soda ash and steam, used a second time, makes a favorable job, but we have found slight odors left in the car, which, in our opinion, leave the car after a certain period of time. Then, again, we are entirely successful in removing the material as well as the odor. It depends on how long and how much is left or found on the car floors. With a good, high steam pressure, using a superheated steam boiler with dry steam up to 700 or 800 deg. F., cars can be cleaned perfectly.

It is also understood that creosote can be removed from car floors by using alcohol or naphtha, the latter preferred on account of being cheaper. It is understood that the car should be washed out also with hot water or steam. Creosote is made up from coal products and, if a little odor is left in the car, it will not do any harm, disappearing entirely in time.

Several railroads are removing flooring and, in some cases, inside lining when found saturated with oil or grease spots. This is an expensive operation. If the flooring is in good condition, it usually means an expense of at least $80 per car if the entire floor is removed. Some method should be employed to save this expense.

In using strong steam pressure or hot water, it should not be used excessively, as the fiber of the wood raises, causing what is known as "rough floors," which are objectionable, resulting in damage to contents. If,

One corner of a house car which has been cleaned and washed ready for high-class loading

* Abstract of a paper presented before the December meeting of the Car Foremen's Association of Chicago.

† Mr. Swanson is district master car builder of the Chicago, Milwaukee, St. Paul & Pacific.

Oil spots, cleats, steel straps and nails must be removed from this automobile car floor

however, any such cases arise, the condition can be readily remedied by using or having some sort of an electric or air-driven planing machine go over the rough or splintered parts of floors.

Every one appreciates the importance of having clean equipment furnished the shipping public. Therefore, it is very important that we do our utmost to see that the work is done as nearly perfectly as possible through different operations and tests. Supervision of the work should be handled by the car-department forces, always with the thought in mind of giving maximum service to the shippers and traveling public.

Discussion

J. E. Mehan (assistant to superintendent car department, C. M., St. P. & P.): How about burning out oil spots with a gasoline torch, scraping or sweeping off that char and cleaning it out of the car, painting over that black charred spot with quick drying paint? How long has Mr. Swanson been using this gasoline torch? And has he had any case of a car catching fire? I would like to have Mr. Swanson bring out these points.

Mr. Swanson: We have an operator at Minneapolis that's been doing it for the last five years. He is very efficient. He has made himself a pad he places over his knee, kneels down and directs the flame at the oil spot and it is remarkable to see how that oil will siphon up through the floor. He knows when to stop, he does very little damage, if any, to the floor. Probably he gets a little burned spot on top and takes a scraper and removes that. Formerly we did not paint over those spots, but it was suggested that we use a quick drying paint, which we are now using. We are having very good success with it. A test was made to determine if this operation was practical. After we got through with the car we took the regular paper used by the flour mills, heated some sand to a certain degree, warm enough so you couldn't stick your hand in it, left that paper and sand on that spot for about three hours. We came back and there wasn't a spot underneath that paper.

I know of no cases where we have caused any fires. We have a very competent man who closely watches his work. As an illustration, if the oil spot is up near the edge of the floor with possibility of the flame going up under the lining or between the lining and the siding, he has a piece of tin bent in shape from the floor up so that it prevents any flame from getting up there. This is an operation also that each supervisor watches carefully.

M. E. Fitzgerald (general car inspector, C. & E. I.): May I ask Mr. Swanson what is the average cost of cleaning of this equipment under the methods which he suggests, and if he has any figures to indicate the cost where the entire floor and side lining are thoroughly saturated due to leaking cod liver oil, etc.

Mr. Swanson: It is costing us around 78 cents a car. That doesn't take in the cost of switching or the cost of the use of steam, but the actual labor.

E. H. Meckstroth (general car foreman, B. & O. C. T.): If I remember correctly, Mr. Swanson stated that he removed some spots with a torch, scraped the scarred or burned spots and then painted it over. I know we have had cases where we painted the inside roof lining to remove the stains when outside metal roof had been renewed, and when a little paint was splashed on the floor shippers would object to the paint. If you paint the spot over, there being oil in the paint, it seems to me you are getting another oil spot back in the floor. Can you enlighten us on that, please?

Mr. Swanson: I think the paint we use hasn't any oil in it. (Laughter.)

Mr. Meckstroth: In that case, I would like to know what kind of paint you are using.

Mr. Swanson: We are using a quick drying paint, but I haven't heard any complaints from the shippers. It is a well-known fact, gentlemen, when they load flour they use bran in a good many cases and a couple of layers of paper. There isn't much chance of any oil seeping through the bran and the paper. They also paper the sides.

President G. R. Andersen (district master car builder, C. & N. W.): It is very encouraging to hear, Mr. Swan-

The familiar card, the application of which results in cars being switched to the cleaning track

son, that it is possible to remove oil spots regardless of how thoroughly they may be soaked into the floor. To be a little specific with the thought of getting some information that we are all interested in, I would like to ask two or three questions. First, you made the statement that you were using a torch for the removal of oil spots. Will you kindly describe just what kind of a torch is being used for this purpose? Second, I would like to ask if the price quoted of 78 cents per car is an average price. Certainly you cannot clean oil spots from an entire floor for 78 cents. Third, I would like to ask your method of removing taint, such as glue stock and salt hides.

Mr. Swanson: The gasoline blow torch we use is called the "Universal Gasoline Blow Torch." They have the half-gallon and gallon containers in connection with the torch.

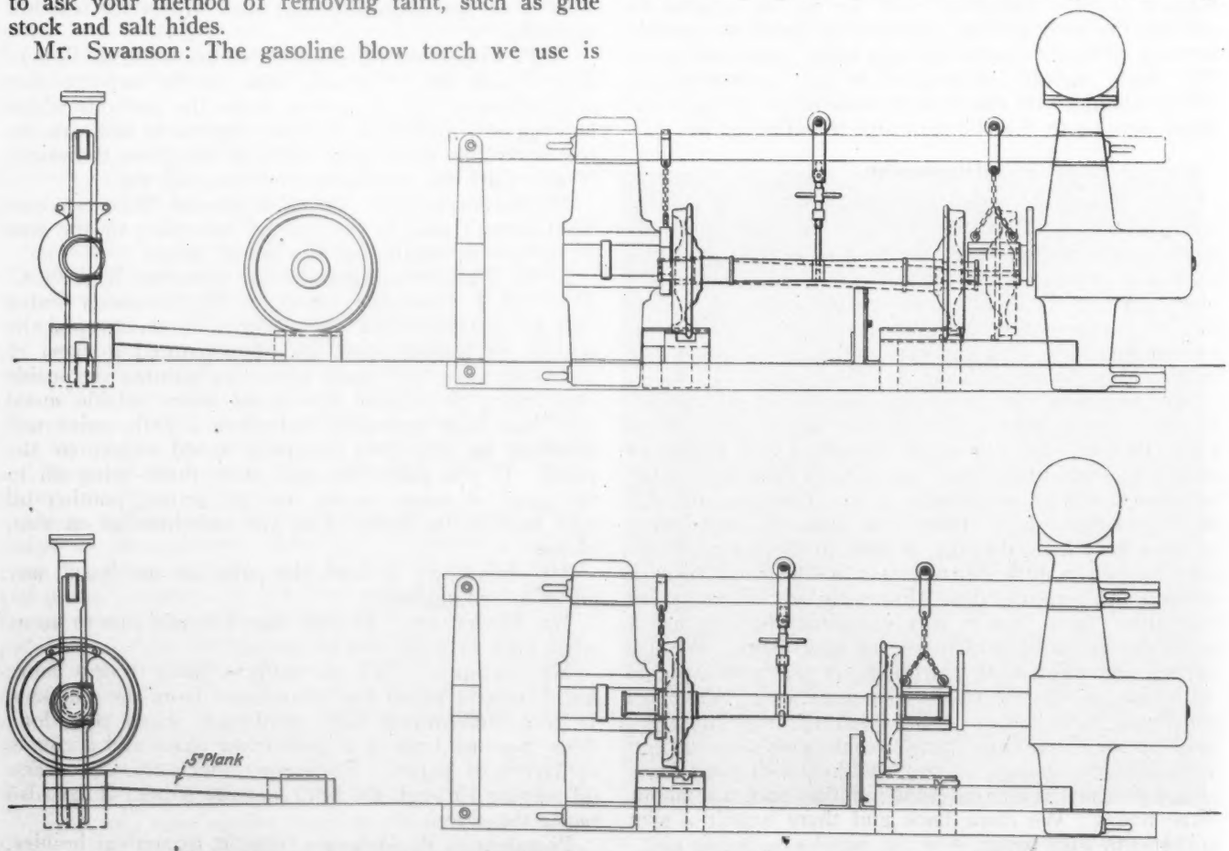
Second question. Seventy-eight cents is the average price. We have some that will cost $1.50, some $2; then again we have some that will cost less. That is the average price for the month. The more cars we clean the less our costs. I guess that is true of all operations.

In connection with the removal of taint caused by glue stock and salt hides, we have been successful in using the caustic soda and steam and then washing it out with soda ash. We have had cases where we haven't done the job 100 per cent. Again, we have had cases where we have done a perfect job.

Applying Two Wheels With a Single Pressing

MANY wheel shops follow the practice of applying one wheel to its seat and then reversing the axle to apply the mate wheel. This procedure can be improved upon with respect to time by arranging and equipping the wheel press as shown in the drawing. The wheel press is located in the shop with sufficient floor space on the loading side to install an incline of 5-in. plank and a grooved-plate flange guide as shown. It should be so placed that wheels and axles can be routed either from storage or from the axle lathes and boring mills to the press and thence with the assembled wheels and axle to finish storage, to be loaded for shipment or disposed of as desired.

The arrangement drawing at the left top shows the wheels in progress up the incline to the grooved flange



Arrangement of a wheel press for the simultaneous application of both wheels to an axle

guides. The axle is swung at the center on a monorail screw hoist, which permits the axle to be moved along the monorail, as shown. A hollow block swung on a chain and hook from the monorail holds the wheel in vertical position against the housing post of the press. The flange groove prevents the wheel from tipping or sliding away from the block. With the stationary wheel in place, the axle is then moved into position as shown in the top drawing at the right.

The mate wheel is rolled into position as shown by the dotted lines. The axle is moved to the wheel center. A block, also swung from the monorail, is inserted between the head of the press and the wheel. The movement of the press forces the grooved flange plate from right to left as shown, until the wheels start moving over the wheel seats. Then with the aid of the monorail screw hoist the wheel flanges come to rest on steel plates, as shown, which serve to keep the axle and wheels in position until both wheels are pressed on their respective seats.

Reboring Car Brasses

IN accordance with the American Railway Association requirements. all car brasses on the Chicago & North Western are being rebored 1/32 in. before relining. Most of this work is being done at the Chicago shops of the railroad, using a Henrickson car-brass boring machine in which certain modifications have been made. Those familiar with the machine, which is illustrated, will recall that the brass rests on one guiding sector along which it slides under the action of a feed screw, passing a revolving cutter which removes a certain amount of material and then onto a second guiding sector which is set higher than the first by the amount of the cut removed.

When reboring babbitt-lined brasses, only enough of a cut is taken to clean up the surface. For reboring the brasses mentioned, however, the second guiding sector is set 1/32 in. higher than the first to correspond with the increased cut being taken. It was found necessary to decrease the feed of the machine by changing the feed screw from one with a four-pitch thread to one with an eight-pitch thread.

Henrickson machine as provided with reduced feed and Carboloy cutters for boring brasses before relining

Since cast brass, with a tough skin more or less impregnated with sand, is notoriously hard on cutting tools, cobalt high-speed steel cutters were first used at a speed of 205 r.p.m. for all sizes of brass. This is equivalent to a cutting speed of 295 ft. per min. on a 5½-in. brass. Experience indicated that a production of only 100 brasses was secured per grinding of the cobalt cutters on the average.

Inasmuch as this was not a satisfactory performance, Carboloy cutters were inserted and the speed increased to 380 r.p.m., equivalent to a cutting speed of 547 ft. per min. on a 5½-in. brass. A production up to 1,800 brasses per grinding of the cutters was thus secured by their insertion which permitted the speed increase.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies whch are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Joint Evidence Not Conclusive

On March 11, 1929, the Texas & New Orleans removed an F-1 New York triple valve from Trinity & Brazos Valley car 1823 and applied a K-1 Westinghouse triple valve, charging for the repairs plus C.O.T. & S. The T. & B.V. refused to accept the charge stating that nine days later the brakes on the car became inoperative and that it was necessary to scrap all of the K-1 triple valve except the body. It furnished joint evidence to the T. & N.O. to this effect and requested that the charge be confined to the triple valve body and C.O.T. & S. It contended that the triple valve applied by the T. & N. O. was scrap and unfit for service, stating that it is practically impossible to wear the parts out in nine day's service.

The T. & N.O. refused to cancel the charges as made, claiming that the charge was correct as per Item 29 of Rule 111. It stated that the triple valve was cleaned, repaired and passed over a standard 3-T triple-valve rack and that, when applied to the car and individually tested, the brakes operated properly.

In rendering its decision the Arbitration Committee stated: "Joint evidence does not prove conclusively that the check valve case was broken when triple valve was applied by the Texas & New Orleans nine days previous. Failure of this item could have occurred in fair usage subsequent to application. Car owner is responsible. Interpretation No. 2 of Rule 60 applies." *Case No. 1651—Trinity & Brazos Valley vs. Texas & New Orleans.*

Charge for Brake Beam Slide Chairs

On February 21, 1929, the Union Pacific applied two A.R.A. No. 2 plus brake beams, without third-point suspension, to St. Louis-San Francisco car 145869 in place of two A.R.A. No. 2 plus brake beams with third-point suspension (owner's defect) and issued a defect card

authorizing the correction of the wrong repairs. The wrong repairs were corrected by the S.L.-S.F. and charges made for two second-hand brake beams and two-brake-beam chairs.

The U.P. took exception to the charges for the brake beam chairs, contending that the charge and credit for the two second-hand brake beams should be authorized by Item 210-A of Rule 101 and Interpretation 23 of Rule 17, as the rules provide but one price for a second-hand No. 2 brake beam completely equipped with or without third-point suspension. The owner contended that Item 210-A of Rule 101 covers the price of a No. 2 brake beam with or without the third-point suspension feature or extension jaws in the brake-beam fulcrum, but does not include the price of the sliding chair. Although a charge was made to cover the cost of the sliding chairs applied at the time the wrong repairs were corrected, the U.P. was advised that this charge would be canceled if the sliding chairs, removed at the time the wrong repairs were made, were returned.

The decision of the Arbitration Committee in this case is as follows: "The prices for brake beams, per Rule 101, do not include the brake-beam slide chairs. The question of whether these details should have been covered by the defect card would depend on the circumstances. If they were missing or defective at time of making wrong repairs, owner would be responsible. If they were removed in good condition at time of making wrong repairs, they should have been defect carded." *Case No. 1652—St. Louis-San Francisco vs. Union Pacific.*

Responsibility for Damaged Ore Car

The B end of the Duluth & Iron Range ore car 10384 was found to be driven in and the sheets buckled while on the Northern Pacific tracks at Duluth, Minn., January 26, 1929. The owner stated that the car was of special design and that from experience it knew that the car must have been damaged while loaded, because if it had been subjected to rough usage when light it would have buckled in the center. This, the owner contended, placed the responsibility on the N. P. because the car was placed loaded on the N. P. tracks on January 19, in perfect condition and when returned empty on January 26 it was found to be in a damaged condition.

The Northern Pacific contended that the car was damaged when light by the transfer crew on January 26. It also contended that the defects were of such a nature that the owner would have been responsible for the damage even if the N. P. crew had been the cause of it because the car was inherently weak in construction. The N. P. pointed out the fact that the car was built in 1909, that it had neither longitudinal nor end sills and that in other ways it was also of weak construction. It also stated that, apparently from Question 2, following Rule 44 in the Revised 1929 Code of Rules, the attention of the Arbitration Committee had been called to cars of this type and that their ruling would make it impossible to have a Rule 44 condition on this class of car. There being no Rule 32 condition involved in the case, the N. P. contended that the owner was responsible.

In rendering a decision the Arbitration Committee stated "Car was not subjected to any of the unfair conditions of Rule 32. Owner is responsible."—*Case No. 1653—Duluth & Iron Range vs. Northern Pacific.*

Car Inspectors—Who, What and Why?*

By H. R. Rice†

WE can all remember back a few years when nearly all of the car department supervisory forces came from the car-inspection branch of the service. In those good old days some one evidently circulated a rumor to the effect that car inspectors were the cream of the car department and gradually the average car inspector, too, reached the conclusion that he, somehow, was endowed with some sort of super-intelligence which immediately becomes effective with his appointment as a car inspector.

Believing that he possessed all of this knowledge mentioned, it became necessary for the car inspector to use the knowledge, and he did; sometimes with peculiar results.

The American Railway Association issues a code of rules written as plainly as possible, which is revised from year to year and which governs the movement of cars in interchange. And what does the car inspector do, aided and abetted by his superiors, the car foremen? He takes this code of rules to a series of meetings held at more or less regular intervals throughout the year on his railroad or at his railway club or association, and he exerts himself to dig up trick questions to confuse and confound the makers of the code of rules.

Is the code of rules governing the movement of cars in interchange so complicated that so many meetings must be held and so many hours spent in discussion and argument in order to insure the safe movement of cars?

It does not seem possible that the rules are so complicated that intelligent men must attend meetings month in and month out and year after year and argue about the same old thing.

Too Many Trick Questions

Perhaps it is unfair to blame the car inspector for all of this so-called discussion. I have sat in meetings where the annual revision of the A. R. A. rules was being discussed and listened to long-winded and inconsequential arguments, not by car inspectors, but by chief interchange inspectors, general car foremen and other supervisors; and it appeared that many of the speakers had deliberately interpreted the rules for themselves and then like the Rock of Gibraltar (I should say the Sphinx but the Sphinx is too silent) stood and defied the elements to move them.

I would not want you to think that there is any intention of discouraging the attendance of the car inspectors at staff meetings of the car foremen or at the meetings of the local railway clubs. There is only one way to acquire knowledge and that is through experience and study. It is possible to acquire knowledge through the results of the experience and study of others than your own self. And such meetings provide the vehicle for the acquirement of such knowledge.

However, it is hardly profitable to anyone to attend a meeting where the time is occupied in discussion of trick questions designed primarily to fill up time and which serves no real purpose. The car foreman and other supervisors can set a good example for their subordinates by discussing questions of importance at their staff meetings as well as at the meetings of the clubs or associations, which are usually dominated by car de-

* Abstract of an address before the Indianapolis Interchange Car Inspectors Association held at Hotel Severin, February 2, 1931.

† Mr. Rice is general shop inspector of the New York, Chicago & St. Louis.

partment supervisors and especially at the clubs where the inspectors usually have little to say.

But, so long as the supervisors attend such meetings as this, and have their inspectors attend such meetings and then consume a great deal of time in insipid arguments, just so long will the car inspectors think and act along the same lines, for the attitude of the supervisors is naturally reflected in the attitude of the subordinates and as a result the code of rules fails in many instances to serve its purpose which is, primarily, to accomplish one thing to expedite the movement of traffic.

The traffic departments of all railroads are striving to obtain more business and one of the greatest aids that the mechanical department can give the traffic department is a low ratio of delay because of mechanical-department inspection. There are times, however, when the attitude of our inspection forces toward the enforcement of some real or imaginary, and usually unimportant, technicality of the rules, may delay the car and lose the business.

We are all familiar with the situation the traffic departments are combating in relation to highway trucking. Here in Indianapolis the I. C. has a car for Muncie. They deliver the car to the Belt; the Belt delivers the car to the Nickel Plate; the Nickel Plate switches the car into a train and moves it to Muncie and another engine switches the car to an industrial track. In this instance six crews of five men each have handled the car for a short haul that might have been handled by one truck with possibly two men.

Why Not Try to Expedite Traffic?

How much better it would be if the meetings were devoted to informative discussions of ways and means of expediting freight movement through terminals and inspection points—or discussions of the railroad companies' policies in connection with car repair programs. No one is in a better position to determine whether or not enforcement of the A.R.A. rules results in delays to traffic than the car inspectors. If the intent of a rule is in error there are methods by which the rule may be changed, but if traffic is lost it is mighty hard to get back again.

How much more information could the inspector get out of a meeting if the speaker discussed methods used in expediting traffic on his road and the inspector profited thereby rather than if the speaker had dug up a trick question which consumed an hour's time in discussion and meant nothing after it was finally laid aside? I imagine that it would benefit him considerably more.

Why not have some discussion by the industrial inspectors in connection with the faults or failings of the loading rules? The other inspectors see the results of improper loading and a get-together should help.

Why not discuss the lack of uniformity in the selection of cars for commodity loading? This is a fertile field for a live discussion. I dare say that it would be hard to get an agreement between any considerable number of inspectors here tonight as to just what constitutes the proper car for certain commodities. And still we must depend on commodity inspection by many men, all of whom appear to have a different idea as to just what is required for any specific commodity. A little comparison in a meeting of this nature or a foreman's staff meeting would iron that difference out.

There are many live subjects that might be discussed profitably at foremen's staff meetings and at meetings of railway clubs without devoting a considerable part of the time to technicalities. The foreman should endeavor to confine the questions to live subjects and the inspector should try to be as live as the subject under discussion.

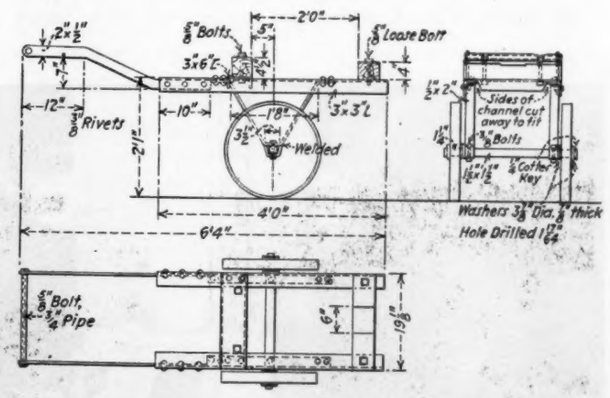
Many of the clubs or associations should take the same advice. Granting that it is sometimes difficult to secure speakers and that the subject committee sometimes has a most thankless job, it still appears that there are times when the papers presented are not exactly fitted to the occasion.

Why pick on some car department supervisor to prepare the papers, or some supply representative? I suppose that this organization, like many similar ones, complains that the car inspectors come to the meeting and do not take any part. Mr. Car Foreman, can your inspector come up to this meeting and speak his mind without hurting your feelings? Do you believe that his opinion is worthless? Try giving the inspector an opportunity to prepare a paper some evening and you may get a shock. Let him "speak out in church" as the saying goes. Perhaps you will learn something.

In the forepart of this paper I have made some remarks in connection with the car inspector's knowledge. I wonder if the car-department supervisors cannot indulge in introspection and determine wherein their own responsibility lies in connection with some of the peculiar things their car inspectors do. As the immortal poet Burns says, "O wud a power the Giftie gie us; to see oursels as ithers see us." The car department supervisors would probably see in their inspectors, reflections of all of their own idiosyncracies. And no doubt profit thereby.

Truck for Carrying Freight-Car Couplers

SHOWN in the drawing is a truck especially designed for carrying freight-car couplers. It has a height over-all of 2 ft. 5½ in. The coupler is carried on the truck with the head toward the handle. To apply a coupler and gear, the truck is pushed underneath the end of the car so that the shank of the coupler is between the draft sills. The height of the truck is such that adjustments to get the coupler in position require little effort. The truck is especially adopted for the standard coupler height of 34½ in. from the horizontal center line of the coupler and the top of the rail.



This two-wheel truck saves labor in applying couplers to freight cars

The chassis is carried on two cast-iron wheels 18 in. in diameter. No supporting legs or wheels to prevent tipping are required, as the truck is under a car when standing loaded.

In the

Back Shop and Enginehouse

Shop Devices Used On the C. & N. W.

MODERN shop tools and machinery are essential to the efficient operation of any railroad repair shop. Of almost equal importance are the many special tools, jigs, and labor-saving devices found in any well-organized shop. In fact, these special methods are considered by most competent observers of shop operation to afford a good index of the energy, resourcefulness, ingenuity and good judgment of the supervisory forces and shop management.

Among the many railroad shops amply provided with labor-saving devices, in almost every department, are those of the Chicago & North Western at Chicago, this being true in both the locomotive shop and the car shop. The several devices described in this article were selected at random from a great many developed in the locomotive department and which might have been mentioned.

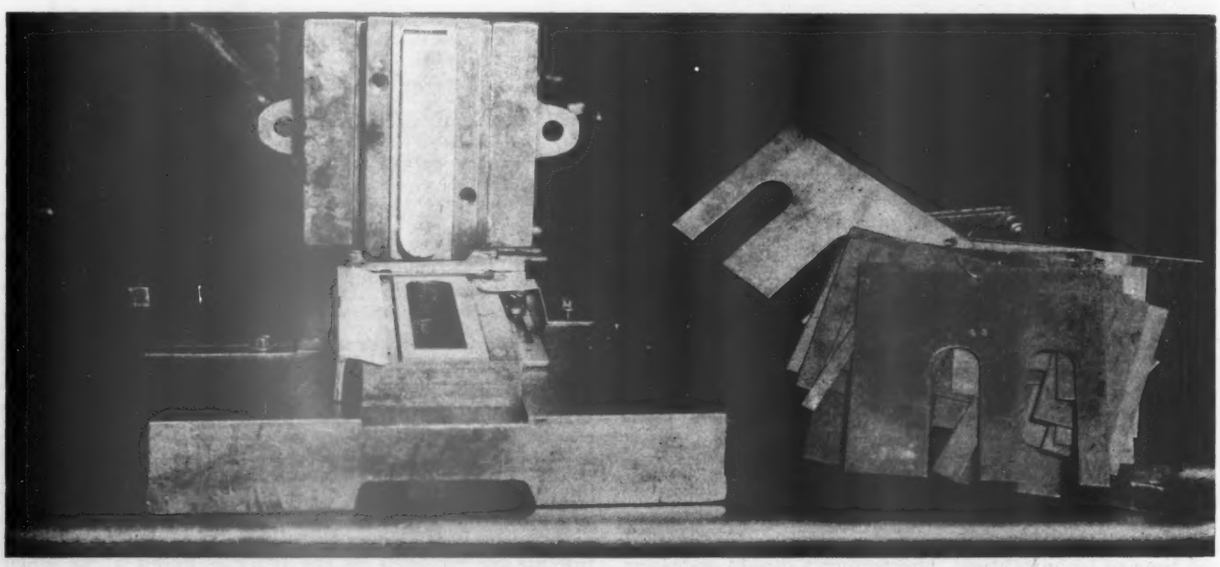
Making Guide Liners

One of the small jobs which consumes a large amount of time in the aggregate in locomotive shops is the making of guide liners, or shims, for use in lining guides, especially when erecting-shop men are permitted to cut these liners out of metal of the required thickness with a hand chisel at the bench. On the other hand, the number of liners of any one size required is usually so small that it is hard to justify the cost of making a set of dies. At least, this was the experience of the North Western, which, on investigation, discovered that a total of 47 different sizes, styles and designs of guide liners were required for locomotives coming in for repairs. Patterns of some of these liners are shown at the right in one of the illustrations, and at the left is shown a single die and punch with adjustable features by means of which any one of the guide liners can be made.

In developing this special guide liner die, the requirements were studied and a certain size of slot (1-9/16 in. wide) agreed upon as standard and suitable for all liners. A single die and a punch were then manufactured of high-carbon steel and secured in suitable recesses in the base plate and in the top header plate, respectively, by means of six screws. The base plate is recessed at the bottom to provide room for the blanks which are subsequently removed and used as number tags for various locomotive parts.

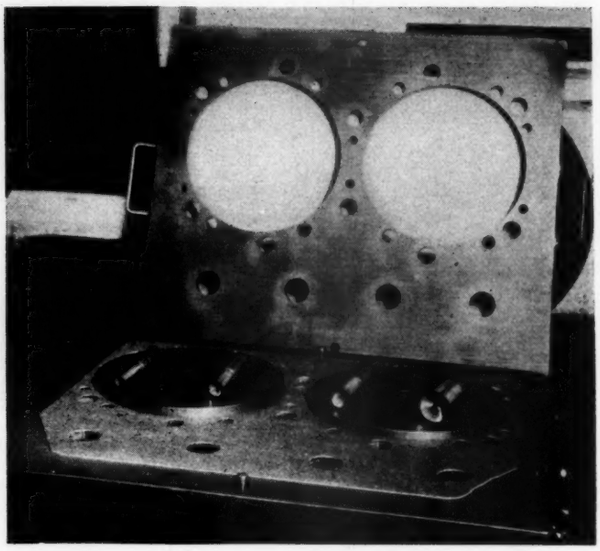
In making liners, they are blanked out to the particular size required on the squaring shears. A close examination of the illustration will show adjustable brackets which are then set to locate the slots as called for in the particular design. As many liners as desired are then run through the punch press, one slot being cut at each stroke of the press. The guiding brackets are then set to bring the second slot in the proper location and the operation is repeated. The punch itself is ground straight and the die relieved in accordance with the usual practice. The face of the die is purposely ground 1/32 in. convex, lengthwise of the slot, to give a shearing action, thus resulting in a smooth cut. A stripping plate removes the liner from the punch on the upward stroke of the press. Guide liners are made with this die and punch design out of different thicknesses of sheet iron varying from No. 24 to No. 18 gage. A production of upwards of 1,000 per 8-hr. day can be readily secured.

Another operation efficiently done at the Chicago



Guide liner die and punch—Templates of liners designed with standard slot width

Punch press and dies used in making clamps for copper pipes



Gasoline-engine cylinder-head gasket cutting device

shops of the North Western, on the same punch press as that used in making the guide liners, is the manufacture of small clamps used in securing copper pipe to a locomotive jacket by means of Parker-Kalon screws. These clamps, shown at *A* in one of the illustrations, are made of No. 18 gage sheet steel, being provided with a semi-circular recess to accommodate the pipe and with two holes punched to receive the screws.

The small dies used in this case are secured to the base plate and to the top header plate in the usual manner, being designed so that the two progressive operations required are performed one after the other and a clamp turned out for each stroke of the machine. Sheet steel strips of the proper gage and width are simply fed to the machine. the first stroke forming the half-round recess in the clamp and the second punching the two holes and shearing the half round ends all at one time. Each subsequent stroke of the machine, therefore, performs the first operation on one clamp and the second operation on another. A production of four to five thousand clamps in eight hours is secured.

Gasket-Cutting Device

A considerable amount of gasoline-electric rail equipment is now in operation on the Chicago & North Western and, whenever necessary, for any reason, to remove the engine heads, new gaskets are usually applied. These gaskets, made of a composition material, were formerly purchased new from the manufacturer, but are now made at Chicago shops. Inasmuch as the relatively small number of gaskets used prohibited the making of expensive dies for the operation, the comparatively simple gasket-cutting device, illustrated, was devised, which permits the railroad to make its own gaskets with a total saving, including labor and material, of 75 per cent.

The device consists of two ¾-in. steel plates, planed down to a true surface on one side of each plate only, and provided with two locating pins and corresponding holes so that when the upper plate is placed on the lower it always takes exactly the same relative position. For convenience, the upper plate is provided with two handles to be used in removing or applying it. Both of these plates are laid out and drilled for the various port and bolt holes required. Two large holes in the upper plate, corresponding to the cylinder bores, are an accurate sliding fit on the two flat cylindrical pieces pressed into the cylinder bore holes in the bottom plate of the device. Four punches, of the various sizes required, are made to be an accurate sliding fit in the small holes and are ground concave on the ends, as illustrated.

The first operation in making the gaskets is to cut the material or packing to the proper size on squaring shears in the tin shop. A templet is then applied to locate the cylinder centers, a trepanning tool being used to cut out circular sections of the packing corresponding to the cylinder bores. The gaskets are then placed over the cylindrical projections corresponding to the cylinder bores in the bottom plate, and the top plate is lowered in place, being positioned accurately by the locating pins and cylinder bore holes mentioned. The weight of the upper plate holds the packing in place while the small punches are being used to cut out necessary holes in the packing. One blow on the punch with a wooden mallet is sufficient to make a clean, accurately located hole. After all of the holes have been punched, the top plate is removed and the gasket is found to be smoothly and accurately cut. The production is about 75 gaskets in eight hours. Gasket-cutting plates of this type have been developed for the various sizes of gasoline engines now used on the North Western and, owing to the simplicity of the device, only a relatively small investment is involved.

Globe Valve Tester

The modern locomotive requires for its successful operation an increasing number of valves of different types, perhaps the simplest of which is the ordinary globe valve. These valves must, to a greater extent than ever before, stand high pressures, operate easily and be tight. To assure the existence of these qualifications, all valves on general repair locomotives at the Chicago shops of the North Western are taken to the brass room on the balcony, thoroughly overhauled and tested in the device illustrated. This is simply a quick and convenient means of putting a water test on the valves without the labor of screwing them onto the test line.

The device is mounted on a bench adjacent to the

Modern Universal tool-room miller machining a keyway or groove in a signal equipment part

steel compartments where valves awaiting repairs and those overhauled are located. The device comprises a base plate through which the shop air pipe passes and on which the valve rests, being held in place by a cross bar attached to the plunger of a small air cylinder. The latter is supported, as shown, on two 1-in. studs threaded into the base plate of the device. A three-way valve, with suitable handle, provides for the supply and exhaust of air to and from the cylinder. False seats, provided with leather gaskets, are available for use with valves of different sizes.

In operation, therefore, a false seat of the required size is placed in the testing machine and the valve held on this false seat, while the air pressure is applied and the plunger comes down to hold the valve firmly against the 90 or 100 lb. usually carried in the shop air line. The cavity in the upper part of the valve is then filled with water and air pressure applied from the underside, any leak in the valve being immediately apparent by the passage of air through the water. The simplicity of this device gives no measure of its effectiveness, as will be appreciated by anyone who has ever tried to test valves by screwing them on to a test line, or possibly permitting defective valves to go back to the locomotive, give trouble and have to be removed for repairs after being applied.

Simple device which saves labor in testing globe valves

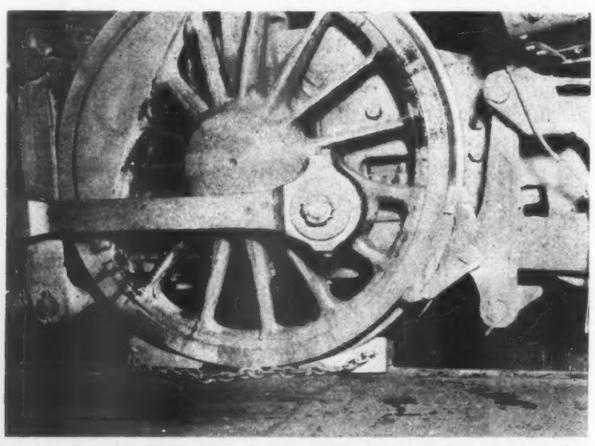
A similar device, with only slight necessary modifications, has been developed for the testing of angle valves.

Tool-room Miller

A machine which is giving a very good account of itself in the tool-room of the Chicago shops of the C. & N. W. is the Brown & Sharpe No. 3A universal miller, illustrated. This illustration shows the machine being used in conjunction with a B. & S. dividing head for machining the odd-shaped keyway, or groove, in a lock plunger forming part of the signal equipment. This use simply serves to indicate the wide variety of operations which a railroad tool-room miller is sometimes called upon to perform, and for which the universal miller is well adapted. This milling machine is notable for rigidity, accuracy and ease of operation, quick return of the table and the work being provided in all directions. The machine is used mostly for the manufacture of special helical milling tools, and taps, which cannot be bought in the open market. Special seating tools for line check valves, angle valves, injectors, etc., are also made on this machine, as well as forming and blanking dies, and all jig work requiring accuracy. High-speed steel cutters are employed so that the operations can be carried out with a minimum loss of time, and the machine is designed to stand the cutting feeds and speeds encountered in this type of operation.

Forged Steel Chock Blocks

IN the illustration is shown an effective set of chock blocks for use as a safety measure under the wheels of locomotives standing under steam. They are



Chock blocks of forged steel with faces machined to fit the contour of driving tires can be used effectively to hold locomotives standing under steam

12 in. long, 5¾ in. wide and 5½ in. high at the heel and, thus, are higher and thicker than the ordinary wooden wedge used for this purpose. After the forging is made, the face of the block is machined to a radius of 26 in. and to fit the contour of the tread of the driving-wheel tire with a recess for the flange. The bottom of the block is slotted to a width of 3½ in. to fit over the top of the rail. Two ½-in. tool-steel pins

are pressed into the face of the slot near the heel of the block, with only the points projecting, thus increasing the friction between the block and the rail should the driving wheel run up on the block. A 15/16-in. hole is drilled through the block at its thickest point for the insertion of a ⅞-in. eye-bolt. Two blocks are joined together by a short length of chain which is attached to the blocks by means of the eye-bolts.

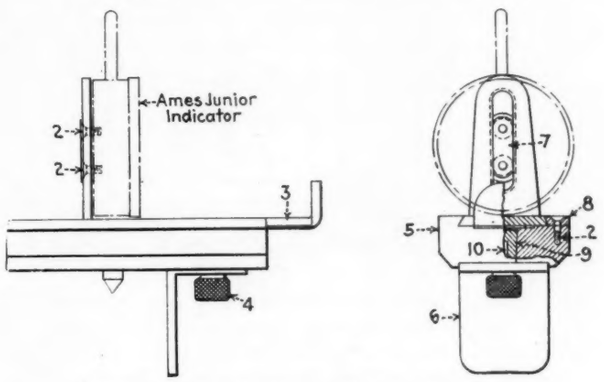
During a test which was made to determine the effectiveness of the blocks, the wheels of a locomotive failed to mount them, the drivers spinning on the rail which resulted in moving the blocks a distance of 2 in. The driving wheels, rolling on the radial faces of the blocks, imbeded the small tool-steel pins in the face of the rail, thus preventing the blocks from slipping.

Bushing Fixture For Ames Indicator

THE fixture or mounting, the assembly and details of which are shown in the two drawings, is used in connection with the Ames Junior indicator, manufactured by B. C. Ames & Company, Waltham, Mass. It is used in the air-brake repair department and tool rooms of an eastern railroad primarily for checking bushings. It is standard practice in the air-brake department on this road to true bushings that vary in excess of .001 in.

The numbered parts on the detail drawing refer to the numbers shown on the assembly drawing. The indicator is secured to the vertical arm of the indicator slide (3) by means of the screws (2) and the block (7). A slot in the indicator slide permits adjusting for height. The indicator slide is machined to fit the grooves in the top of the base (5), and is held in place by the gib (8), which is secured to the base by three machine screws, countersunk as shown. The bracket (6) is machined to slide in the groove on the bottom of the base (5) for purposes of adjustment. The thumb screw (4) screws in the taper block (9), which can be moved to any position desired in the slot in the center of the base (5). Two dowel pins (10), machined for a loose fit in the two ⅛-in. holes in the block (9) are riveted to the top horizontal arm of the bracket (6).

The contact point of the indicator should extend below the base as shown on the assembly drawing. Work to be checked is placed on a flat-finished surface plate in the usual manner, using the vertical leg of the bracket as a rest for the fixture.

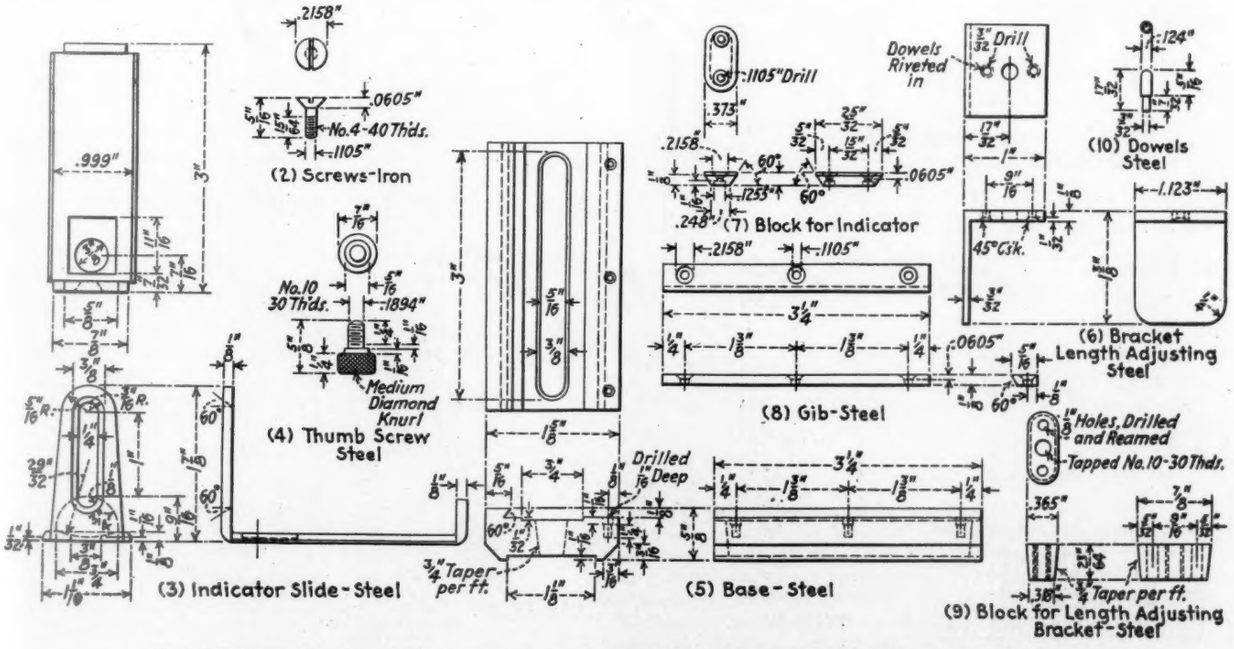


Ames Junior indicator applied to the fixture

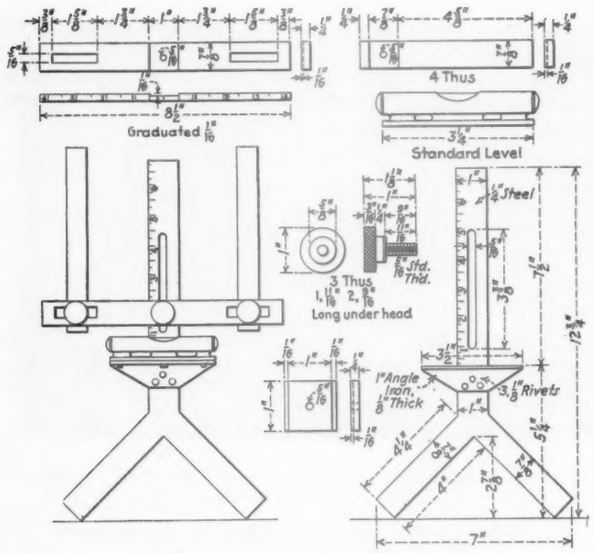
Gage for Setting Up Crossheads

THERE are a number of methods in common use for setting and alining the top crosshead guide after the bottom one has been bolted in position. One method in practice on an eastern road makes use of the common gage shown in the drawing.

The gage consists of a base, the legs of which are set at an angle of 90 deg., a section of 1-in. angle iron, a standard 3-in. level and a graduated scale, all riveted together to form an integral piece. A cross bar, graduated in sixteenths of an inch, is attached to the graduated scale by an 11/16-in., knurled-head bolt which is



Details of the fixture used in connection with the Ames Junior indicator for truing bushings



A leveling gage for adjusting the top guide when setting up crossheads

used to adjust the cross bar vertically in a 3⅜-in. slot cut in the scale. Two vertical pieces of ⅞-in. by 1/16-in. sheet steel are fitted in small slots at each end of the cross member by means of 9/16-in. knurled-head bolts.

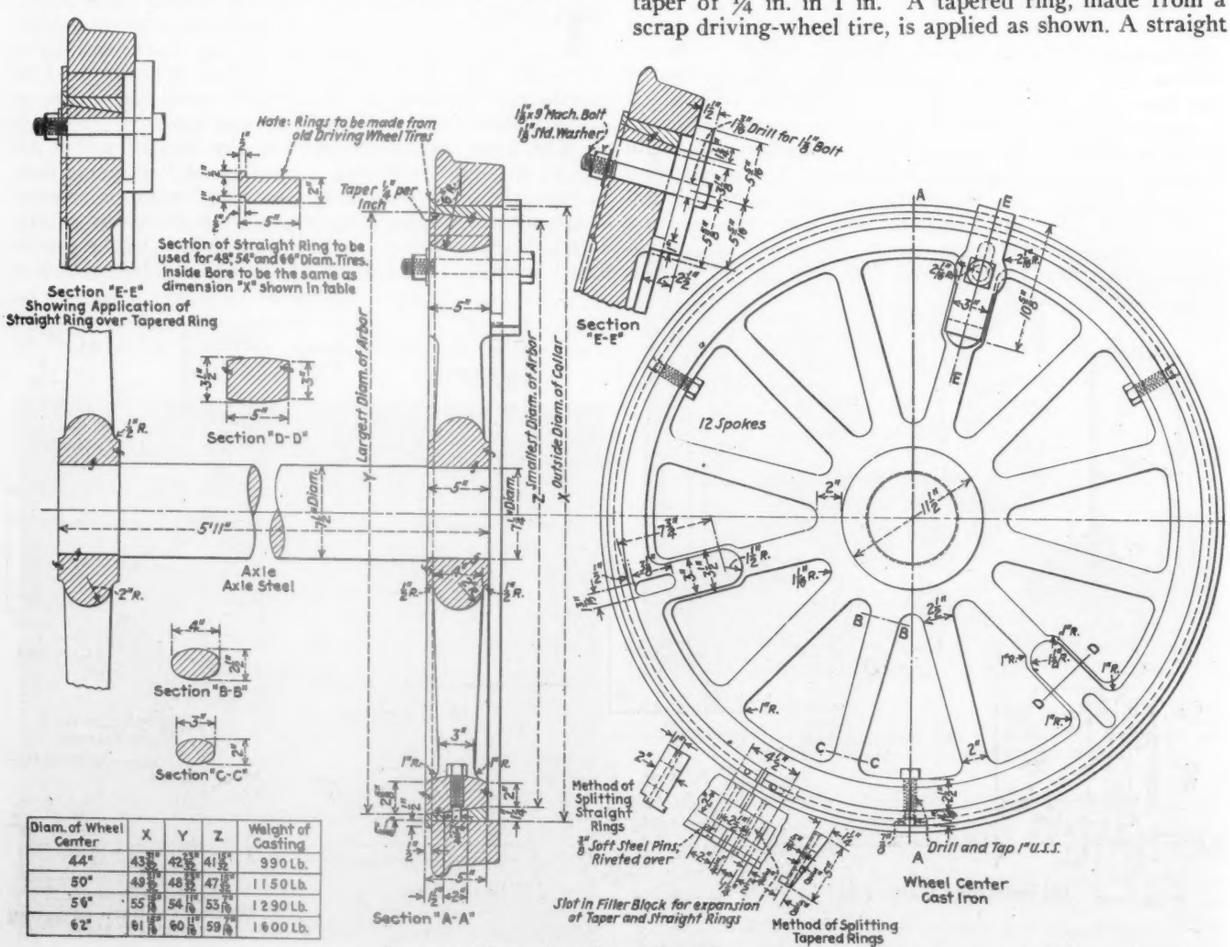
When in use, the vertical members are adjusted horizontally so that the distance between their inside edges is the width of the face of the guide. The cross member is then adjusted vertically after the crosshead has been calipered to determine the distance between the guides.

When the top guide is temporarily applied, a small scale can be set face to face with the vertical graduated scale of the gage to determine what thickness of liner is necessary under the guide to give the crosshead the proper clearance after it has been set up.

When the liners are made and applied, the gage is placed on the bottom guide, which has been set and alined by the usual method of centering a string in the cylinder and extending it back past the guide yoke. As the gage is set at various places on the lower guide and leveled, the top guide is brought into a position which will bring its face between the vertical members of the gage. When the face of the top guide sets between the vertical members of the gage, requiring no further adjustment, temporary bolts are applied, preparatory to reaming the holes for the application of the guide bolts.

Expanding Arbor for Turning Tires

THE expanding arbor shown in the drawing is designed for turning unmounted tires on a wheel lathe. The wheel center is of cast iron and has 12 spokes, three of which are cast and cored as shown at sections *D-D* and *E-E* for 1⅛-in. by 9-in. clamping bolts. The rim of the wheel center is machined with a taper of ¼ in. in 1 in. A tapered ring, made from a scrap driving-wheel tire, is applied as shown. A straight


Note: Rings to be made from old Driving Wheel Tires
Taper 1/8" per Inch
Section of Straight Ring to be used for 48", 54" and 66" Diam. Tires. Inside Bore to be the same as dimension "X" shown in table
Section "E-E" Showing Application of Straight Ring over Tapered Ring
1½ x 9" Mach. Bolt
1⅛" Std. Washer
1⅜" Drift for 1⅛" Bolt
Section "E-E"
Section "D-D"
Section "B-B"
Section "C-C"
Section "A-A"
Larger st Diam. of Arbor
Smallest Diam. of Arbor
Outside Diam. of Collar
Axle
Axle Steel
12 Spokes
Method of Splitting Straight Rings
⅜" Soft Steel Pins Riveted over
Drill and Tap 1" U.S.S.
Wheel Center Cast Iron
Slot in Filler Block for expansion of Taper and Straight Rings
Method of Splitting Tapered Rings

Diam. of Wheel Center	X	Y	Z	Weight of Casting
44"	43 31/32	42 3/32	41 11/32	990 Lb.
50"	49 31/32	48 3/32	47 11/32	1150 Lb.
56"	55 31/32	54 3/32	53 11/32	1290 Lb.
62"	61 31/32	60 3/32	59 11/32	1600 Lb.

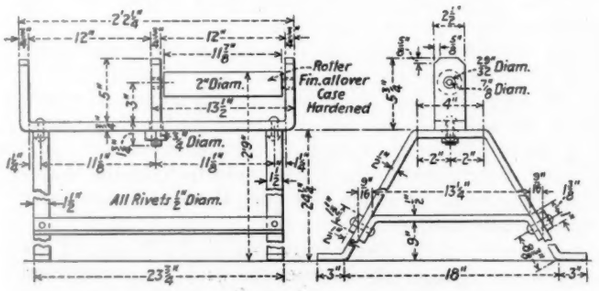
An expanding arbor for truing tires on a wheel lathe

ring can also be used when the inside diameter of the tires require additional diameter for the arbor. Both the tapered and straight arbor rings are split, and a slotted filler block is provided to allow for expansion of the rings. Three 1-in. bolts, turned down to 7/8-in. diameter 1¼ in. from the end, are spaced equidistant around the wheel center to prevent the rings from slipping off. Two-inch holes in the rings allow sufficient free movement of the rings to facilitate the application and clamping of the tires in position.

Tightening the nuts on the three clamping bolts causes the tapered ring to expand around the wheel center and thus clamp the tire in position for turning.

Feed Stands for Use with Power Shears

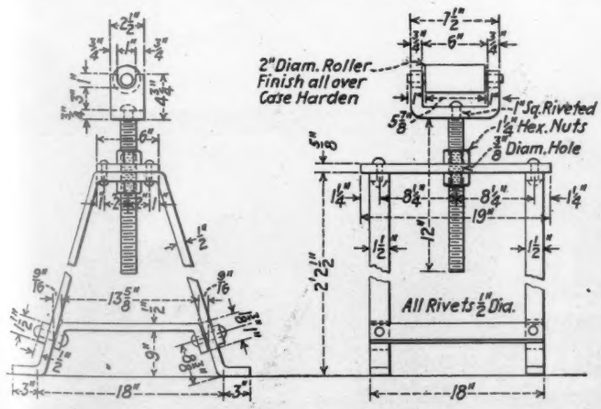
IN the two drawings are shown feed stands which are designed to facilitate the feeding of large and small bars of iron and steel to sheers during production cutting operations. One of the stands consists simply of a 2-in. roller inserted in a yoke, riveted to one end of a 1¼-in. by 12-in. threaded bar which is supported on the stand by two jam nuts. The nuts may be loosened and the



A roller-feed stand designed with a rack which expedites the production cutting of small bar stock

bar raised or lowered to any desired elevation; after which they are tightened against the stand, rigidly holding the roller in its set position. The stand supporting the roller is 18 in. wide, 19 in. long and 27⅛ in. high. The legs and braces are constructed of ½-in. by 1½-in. slab iron, while the top, through which the threaded bar extends, is made of ⅝-in. by 6-in. plate.

The other stand is a combined feed stand and rack



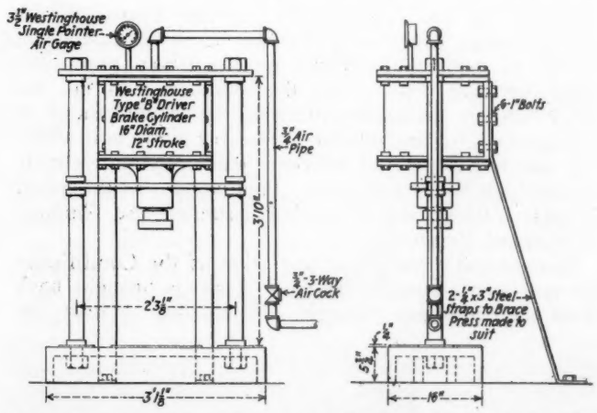
A single roller mounted on a stand to facilitate the feeding of heavy bar stock to a power shear

and is designed primarily for feeding small bar stock to the shears. There is no provision made for elevating or lowering the roller of this stand which is 2 ft. 9 in. above the floor. The stand is made of sufficient strength to permit the storing of a quantity of stock beside the roller, one end of the plate forming the top of the stand being flanged up to prevent the bars from rolling off. The stand is constructed of ½-in. by 1½-in. slab iron and is 18 in. wide and 23¾ in. long.

Pneumatic Press for Valve-Motion Bushings

IN shops where considerable rod work is done for locomotives in adjacent enginehouses in addition to the regularly scheduled back-shop work, hydraulic bushing presses are often worked at maximum capacity. This, in many instances, is detrimental to the progress of smaller work through the shop such as the pressing of bushings in various valve-motion parts. Again, it is not always desirable to operate a large hydraulic press for such light work.

The pneumatic press shown in the drawing is especially adaptable for light work. The press, which is 3 ft. 10 in, high and set on a 3-ft. 1⅛-in. by 16-in. by 5¾-in. cast-steel base is designed to be mounted on a work bench and consists of a Westinghouse 16-in. by 12-in. driver-brake cylinder mounted between and near the tops of two 2½-in. by 4-ft. 5-in. round steel rods. The rods are threaded top and bottom, at the top for the application of a horizontal cross brace and at the bottom for bolting them to the cast steel base. A second horizontal cross brace is placed below the cylinder while


3½" Westinghouse Single Pointer Air Gage
Westinghouse Type "B" Driver Brake Cylinder 16" Diam. 12" Stroke
¾" Air Pipe
¾" 3-Way Air Cock
6-1" Bolts
2-½" x 3" Steel Straps to Brace Press made to suit

A pneumatic press for small bushing work which can be mounted on a work bench

two ¼-in. by 3-in. steel straps are bolted to it and to the work bench for supporting the assembled press. In view of the fact that the press is mounted on a work bench the air-operating valve is situated in a position near its base.

FIFTY YEARS AGO.—Freight business on most western railways is now immense, and every wheel is needed to dispose of the rush of agricultural products and merchandise. Lack of cars and locomotives represents the greatest complaint. The shops are crowded with orders for new equipment, some roads are leasing locomotives and cars from others, passenger engines are pressed into freight service, and practically all machinery is compelled to do double duty.—Railway Age, August 5, 1880.

NEW DEVICES

Water Conditioner Tests

THE Locomotive Water Conditioner, developed jointly by the Bird-Archer Company and the Chicago, Milwaukee, St. Paul & Pacific, under the direction of R. W. Anderson, general superintendent of motive power, was first applied to the Mikado-type locomotive, illustrated, about two years ago. From a descriptive article, published on page 165 of the March 1930 issue of the *Railway Mechanical Engineer*, it will be recalled that the principal objectives sought in the development of the device were simplicity, relatively low cost, low maintenance, feedwater heating, storage of hot water, feedwater treatment and removal of oxygen. It is too early yet to say to what extent all of these objectives will be attained under all conditions of service. The first three are more or less inherent in the design. There is no question about the hot water storage feature, and tests indicate that an average feedwater temperature of 208.6 deg. F. is readily attainable, as well as an average oxygen elimination in excess of 82.4 per cent. The success of service tests of the device on the Milwaukee to date are such that, besides the two light and heavy Mikados already equipped, five additional installations are now being made, including one on a converted 2-6-6-2 type locomotive.

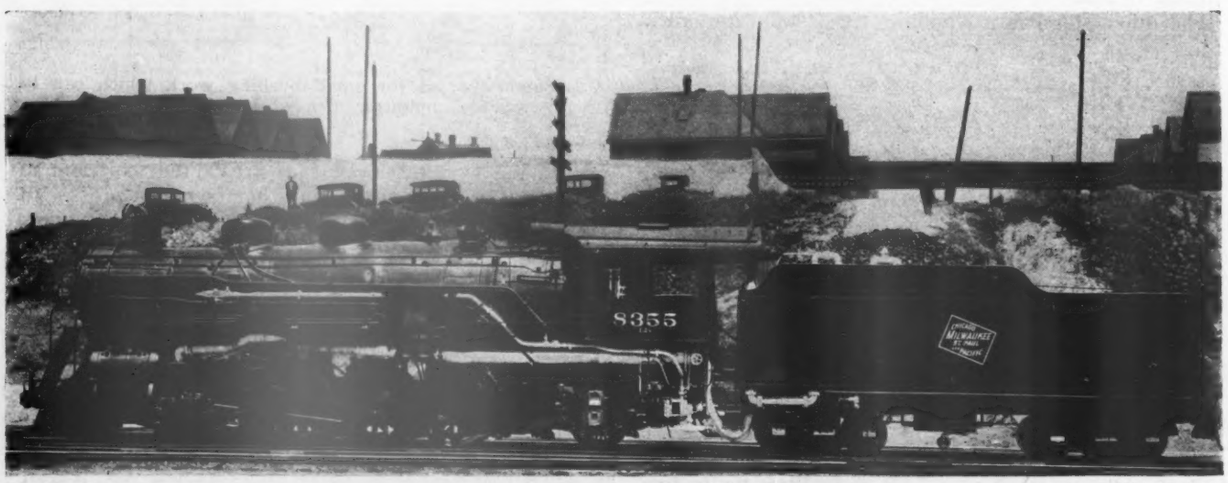
A number of important improvements have been made since the Locomotive Water Conditioner was first described in the *Railway Mechanical Engineer*, the principal ones being the application of an exhaust steam ejector to replace the small turbine-driven pump for supplying cold water from the main tank to the hot water storage compartment; and the development of an improved, turbine-driven, feedwater pump unit which will take hot water and deliver it efficiently and reliably against high boiler pressures. This pump was described on page 719 of the December issue of the *Railway Mechanical Engineer*.

The general principle of operation of the Conditioner has not been changed. Exhaust steam is brought back from the cylinders through a 6-in. pipe to heat the water in one leg of the tank which has been partitioned off to form a hot-water storage compartment of 700 gal. capacity, or more, dependent upon the needs. The temperature of water in this compartment is held uniformly at or near the boiling point, as long as exhaust steam is available, by means of a thermostatically-operated exhaust-steam control valve. A fixed water level is maintained in this compartment, as long as the locomotive is in operation, by means of a float which operates through a Crane butterfly valve to control the supply of steam to the ejector. When the locomotive drifts or stops, this supply of stored hot water may be drawn upon to feed the boiler through the boiler feed pump. The design is thus adapted to assure the full benefits of feedwater heating, not only to road locomotives, but to yard, switch, transfer and other locomotives in intermittent service.

Feedwater Temperature Maintained in Excess of 140 Deg. F.

An ingenious and effective device is provided to prevent the possibility of injecting cold water into the boiler at any time, whether the locomotive is working or not. Should any attempt be made to start the boiler feed pump when water in the storage compartment is at less than 140 deg. F., high-pressure steam is admitted to the water at the pump suction under the control of a thermostatically-operated live-steam valve. Just as soon as exhaust steam is available to heat the water in the compartment above 140 deg., the live-steam valve automatically closes.

As a result of the above provision in the design of the Conditioner equipment, its operation has been rendered as nearly automatic as possible, boiler feeding being reduced to its simplest form, or, in other words, a one-valve operation, with the equipment available for use at all times. The boiler feed pump steam valve in the cab is the only one requiring the attention of the engine crews, all other valves in the equipment being entirely automatic in action and of rugged construction, designed to give reliable service over a long period, under exacting conditions. The thermostatic control, required on only two of the valves, consists of a thoroughly-tested



C. M. St. P. & P. locomotive on which the Water Conditioner was tested

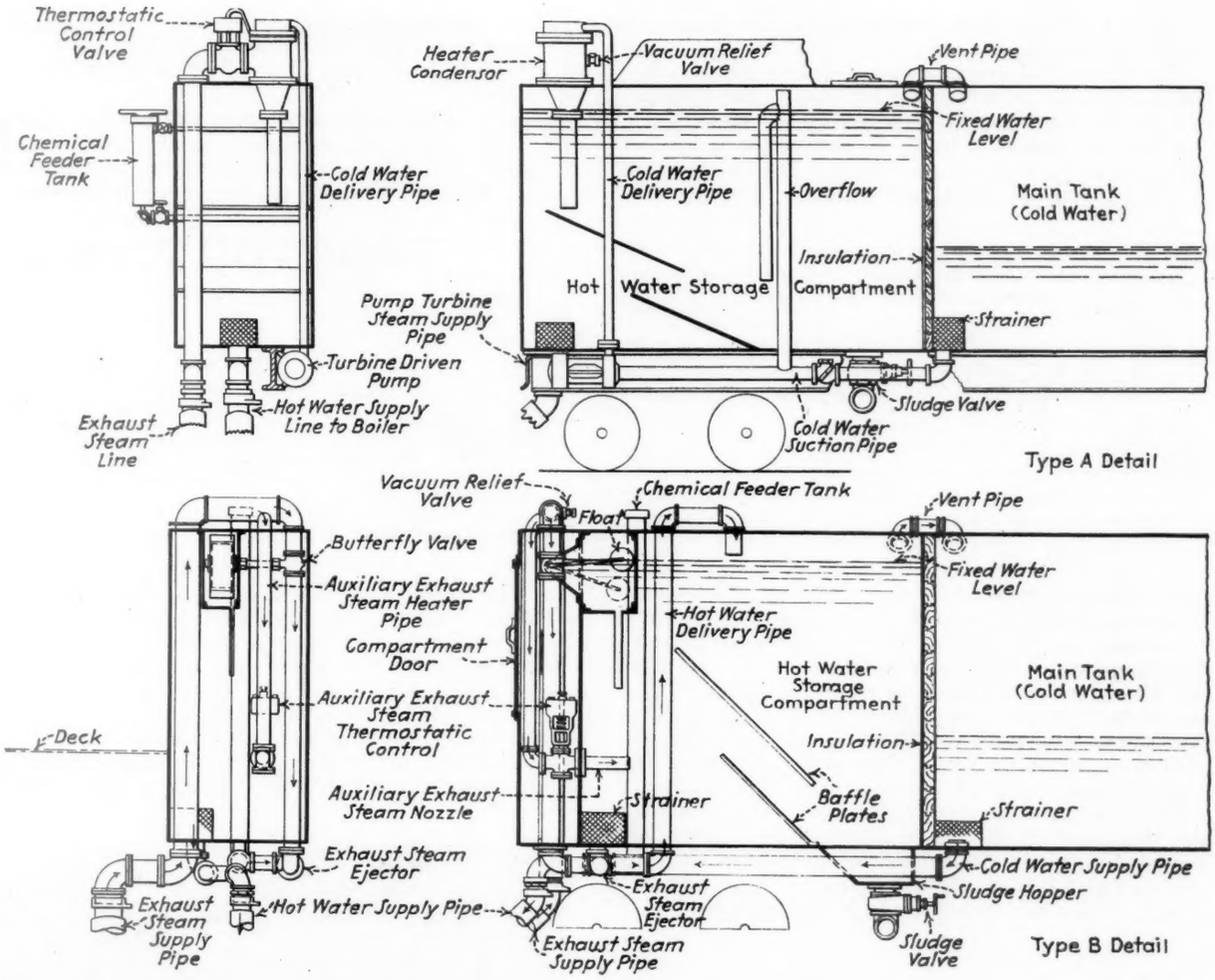
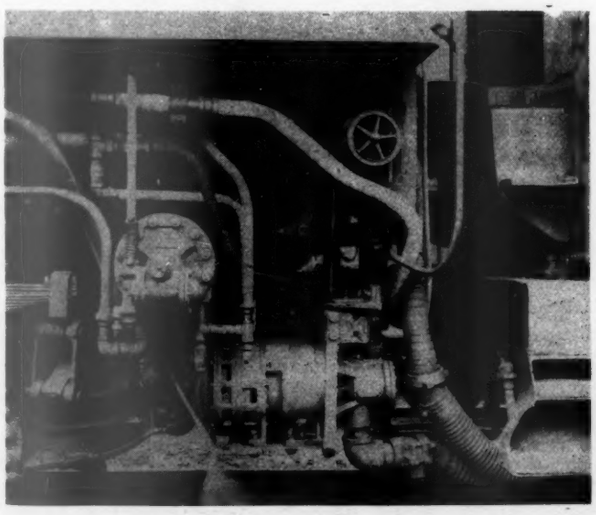


Diagram showing construction of the Type A and the Type B Conditioners as applied to the left water leg of a tender tank

design, especially adapted for use with this equipment by the Fulton Company, Knoxville, Tenn.

Chemical treatment of the water is secured by the insertion of briquettes of the necessary chemical composition in a cylindrical container with removable cap, located on the left water leg of the tank, and connected to the cold-water delivery pipe, as illustrated in the drawing. Cold water, carrying the proper amount of the required chemical solution, then passes to the cold-water delivery line, mixes with exhaust steam in the heater condenser and is delivered to the hot water storage compartment where the chemical reaction is greatly speeded up, owing to the high temperature. Any scale-forming impurities or free mud which settles in the bottom of the compartment can be readily discharged at terminals through the sludge valve, illustrated.



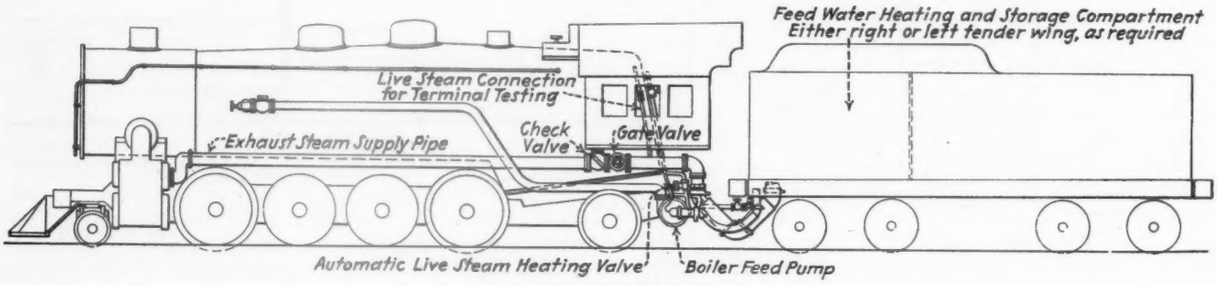
Details of the feed pump and piping application

Two Types of Water Conditioners

Referring to the diagram, it will be noted that the Locomotive Water Conditioner is now available in two types, Type A employing a turbine-driven pump for supplying cold water to the storage compartment, and the Type B employing an exhaust steam ejector for this purpose. In the latter case, cold water flows by gravity to the ejector, where exhaust steam, drawn from the main cylinders, combines with the water and forces it through the hot water delivery pipe to the storage compartment. The heating of the water in the Type B Conditioner is thus accomplished in two stages; first, in the ejector, and, second, by the admission of exhaust steam through the thermostatic control valve directly

in the hot water storage compartment. The ejector is wholly automatic in operation.

Throughout the development period of the Locomotive Water Conditioner on the Milwaukee, the temperature of the water entering the boiler has been closely observed on numerous tests. In addition, test records of temperature and oxygen removal have been made by Dr. D. H. Koyl, water service engineer of the railroad. Doctor Koyl's report shows that on one test run an average temperature of 208.6 deg. was obtained with an average oxygen removal of 89.8 per cent. Twenty-four temperature readings were taken on this occasion and 12 oxygen determinations made of the water that passed through the Conditioner. An average of three tests of this nature showed, however, an average oxygen elimination of 82.4 per cent. The device has been operated without extra labor costs, other than ordinary maintenance, and the cost of the chemicals required for the treatment of the water evaporated. Locomotives equipped with the Conditioner have been successfully operated in territory where both treated and untreated waters, as well as mixtures of the two are handled.


Feed Water Heating and Storage Compartment
Either right or left tender wing, as required
Live Steam Connection for Terminal Testing
Exhaust Steam Supply Pipe
Check Valve
Gate Valve
Automatic Live Steam Heating Valve
Boiler Feed Pump

Piping diagram of a Water Conditioner application

Pease Junior Model Print Dryer

THE Pease Junior Sheet Dryer, manufactured by The C. F. Pease Company, 813 North Franklin street, Chicago, is designed for the drying of moderate sized blue-prints, negatives, blue-line and brown-line prints up to 24 in. wide. Also, when a chromium-plated cylinder is used, it is particularly adapted for drying photo prints. The Junior Model Dryer closely resembles the larger size Pease dryers in design.

Prints are fed into the dryer over a brass scraper rod and up an inclined feed table which drains the water away from the drying drum and prevents steam pockets and creased prints. Beneath the feed table is located an adjustable drip pan where all surplus water is collected. This pan can be raised or lowered as required for handling either long or short prints. After drying, prints are automatically returned into an adjustable tray at the front of the machine which can be pushed back out of the way when exceptionally long prints are being run.

The revolving copper drying drum can be furnished with either gas or electric heating elements; also, it can be had chromium plated when so specified. Chromium plating is recommended for use in connection with drying photo prints as the drum can be easily cleaned with a damp cloth and will not be affected by chemicals.

When equipped with a gas heater, the revolving copper drying drum contains one burner and can be heated to proper drying temperature in about three minutes. The dryer is equipped with a hand-regulated air-mixer valve and consumes approximately 20 cubic feet of gas per hour.

When equipped with an electric heater, the drying drum contains two Nichrome wire heating units which are capable of heating it to proper drying temperature in about 10 minutes. Each of these units is controlled by a separate switch. When operating on 110 volts, the electric heating units consume about 35 amperes and when operating on 220 volts the heating units consume about 20 amperes. The motor operating the drum consumes 1½ amperes. The heating units are automatically cut off when the motor is shut down.

The dryer is constructed with an angle-iron frame finished in olive-green enamel. It is equipped with a ⅛-hp. motor and variable gear drive for two speeds,

The Pease Junior-model sheet dryer

either two or three feet per minute. At the front and right-hand side of the machine is a hand-screw regulator for controlling the canvas band. All parts of the machine are accessible and can be easily cleaned and oiled.

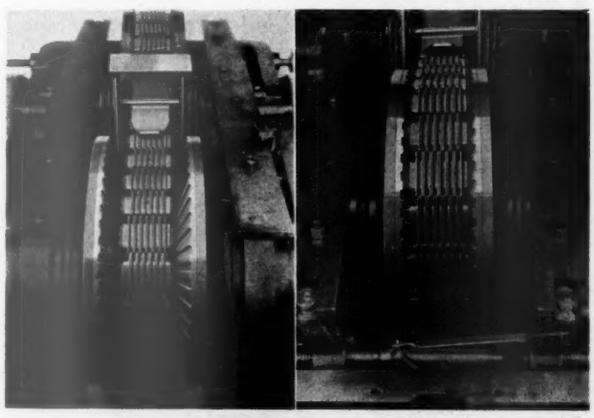
The overall height of the Junior dryer is 5 ft. 3 in. and the floor space it occupies is 3 ft. 5 in. wide by 3 ft. 6 in. deep. The complete machine is shipped fully assembled ready for connection and immediate operation.

Link-Belt Variable Speed Transmission

THE variable speed transmission shown in the illustrations consists basically of two pairs of wheels of the opposed conical-disc type, between which a unique chain transmits power. The effective diameters of each pair of wheels can be altered under load to change the speed ratio, without steps and without dependence on friction. On changing speed, the self-pitching chain rises in one set of wheels and descends in the other, so that while the input shaft connected to a motor or other source of power turns at constant speed, the output shaft is brought to the desired revolutions per minute.

The variable-speed device is designated as the P. I. V. Gear, the initials standing for "Positive Infinitely Variable," indicating its characteristics, and is the product of the Link-Belt Company, Philadelphia, Pa. The wholly original feature of the P. I. V. Gear is its use of a positive chain drive to transmit the power. Radial teeth are cut in the conical faces of the driving discs, and the self-adjustable teeth projecting beyond the sides of the chain are arranged to engage the radial teeth of the discs.

The chain used in the P. I. V. Gear is made up of a series of steel leaves or links with joints consisting of hardened-steel pins turning in segmental bushings. There are no teeth on the inner surface of this chain. Instead, what may be called teeth are made up of packs of hardened steel laminations or slats which extend through slots in the links at right angles to them, and project about ⅛ in. at each side of the chain. The



The tooth formation of the P.I.V. chain on the minimum (left) and the maximum (right) diameter of wheel

individual containers which hold the packs of slats are secured in the openings of the links but, within each such container, the slats are free to slide from side to side individually with relation to each other and adjust themselves to engagement with the radial teeth of the discs over substantially the full range of diameters. The angle of the slat ends is 30 deg., the same as that of the conical faces of the wheels.

The teeth of the discs widen from the center outward toward the circumference, but are of uniform depth. They are staggered relatively on each pair of wheels so that the slats move back and forth into the teeth to mesh correctly as the chain comes into contact with the wheels. Self-pitching of the chain to any tooth width or wheel diameter is thus assured. At each engagement of the chain and wheels, the slats are regrouped within their separate containers, but do not slide nor move under working pull. Their movement in engaging with the wheels is complete before the load is applied.

All the elements of the P. I. V. Gear are built into and protected by an oil-tight housing, and are automatically splash lubricated. The hardened steel wheel faces are mounted on cast-iron hubs backed by ball thrust bearings, and move axially on the shafts, which in turn are mounted in radial ball bearings. The movement of the pairs of wheels together or apart, in order to increase or decrease their effective pitch diameters, is controlled by a pair of pivoted levers operated through a hand control shaft with right-and-left-hand screw motion. Initial chain tension is provided for by an external adjustment screw by two hardened shoes which ride lightly on both upper and lower strands of the chain, under constant spring pressure. A speed indicator permits a ready check-up on operating speed settings.

The unit has been put to production by the Link-Belt Company for the present in five sizes, from 1 to 10 hp. capacity, providing speed change ratios up to a maximum of six to one. It has been tested throughout the past year by continuous operation in driving machine tools, textile equipment, baking, glass- and paper-making machinery.

Dulux—A Synthetic Paint Vehicle

A NEW vehicle for use with interior, and exterior, finishing materials and a group of paints and enamels utilizing it, has been developed by E. I. du Pont de Nemours & Co., Incorporated, Wilmington, Del. Designated as Dulux, the vehicle is used in two forms: Dulux gum serving as a vehicle for enamels and Dulux oil serving as a vehicle for paints. The Dulux vehicles are made by chemical reactions which require extremely close chemical control and which, when completed, have none of the properties commonly associated with the usual resins, gums and oils used in paint manufacture. They are distinct chemical compounds, their properties depending as much upon the method of manufacture and upon control during manufacture as they do upon the ingredients used.

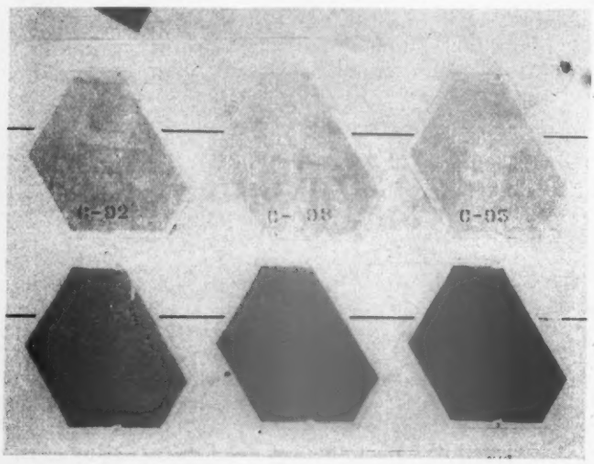
In the Dulux products using these vehicles for interior and exterior enameling, Dulux gum is used to bind the pigment together. This is a rubbery material which hardens to the toughness of horn and is said to have remarkable durability and retention of elasticity. It is dissolved in special solvents to form the Dulux vehicle and in no way is associated with the common practice in making paint vehicles by dissolving resin, fossil gum or brittle synthetic resins in oil by the application of heat. Enamel finishes using this gum as a vehicle are designed for use on machinery, furniture, signs, busses, railway equipment, etc., where a quick-drying, hard, enamel-like finish is desired. In Dulux finishes for exterior and interior painting, an oil-like vehicle is used which gives softer but more durable films than the gum-like vehicle used for enameling. This oil, like Dulux gum, is a synthetic product and has no relationship to the material ordinarily used at present in the paint trade. Finishes from this oil are used in the places where linseed oil or chinawood oil paints are now commonly used, as, for example, on building exteriors, bridge and steel work, etc.

To determine the relative durable qualities of Dulux

oil and linseed oil, comparative tests were made with ordinary vehicles and with the Dulux vehicles by the du Pont Company. Ordinary white-pine clapboard panels were coated, in one case with linseed oil, in another case with heat-bodied linseed oil and in a third case with Dulux oil and placed on exposure racks at an angle of 45 deg., facing south. In six months, according to the records of the du Pont Company, the linseed oils had disintegrated to such an extent that they no longer protected the wood and the panels were badly warped. At the end of two years the panel coated with Dulux oil was still in perfect condition. Numerous other comparative tests were made, all of which are said to have indicated the superior durable qualities of the Dulux vehicles.

Dulux for Interior and Exterior Painting

To test further the Dulux oil vehicle used for interior and exterior painting, equal quantities of a pigment of maximum chalking or fading tendency were placed in a Dulux oil vehicle and in a linseed oil vehicle. The



.0028 in. .0027 in. | .0040 in. .0043 in. | .0062 in. .0076 in.

Top row—Different thicknesses of Dulux oil on polished metal. Bottom row—Similar thicknesses of linseed oil on polished metal. All panels exposed 100 days on a 45 deg. fence at Wilmington, Del. to compare the corrosion of the two vehicles

panels painted with these products were exposed side by side on the same exposure fence at 45 deg. The du Pont records reveal that the linseed-oil paint chalked through to the wood in less than eighteen months while the Dulux oil product was still in perfect condition at the end of that period. The same test was made on panels painted with a pigment of maximum cracking tendency. At the end of eighteen months the linseed-oil paint cracked and flaked through to the wood while the Dulux paint was still giving complete protection to the wood. Similar tests were made comparing Dulux products for exterior painting with ordinary white lead, linseed-oil white exterior paints and with various colored paints with linseed oil vehicles. Invariably, it is said, the Dulux paints withstood longer than the others any tendency to fade, chalk or whiten.

Metal Protection

For the protection of metal, the high resistance qualities of Dulux products were also established to the satisfaction of the du Pont Company by comparative tests, similar to the ones mentioned above, with paints of linseed oil base. In addition, tests were completed to determine the permeability of Dulux to moisture.

From this test, the results of which are shown in the chart, Dulux oil, both clear and pigmented, was found to be approximately three times as impermeable as linseed oil and approximately twice as impermeable as ordinary metal-protective vehicles containing blends of linseed oil, chinawood oil and spar varnish.

Under ordinary conditions Dulux finishes for exterior and interior painting are dust free in three to six hours, and dry enough for recoating in from eight to eighteen hours. They atomize freely and are therefore suitable for spray application but still have enough body to adhere to vertical surfaces without sagging, breaking or running.

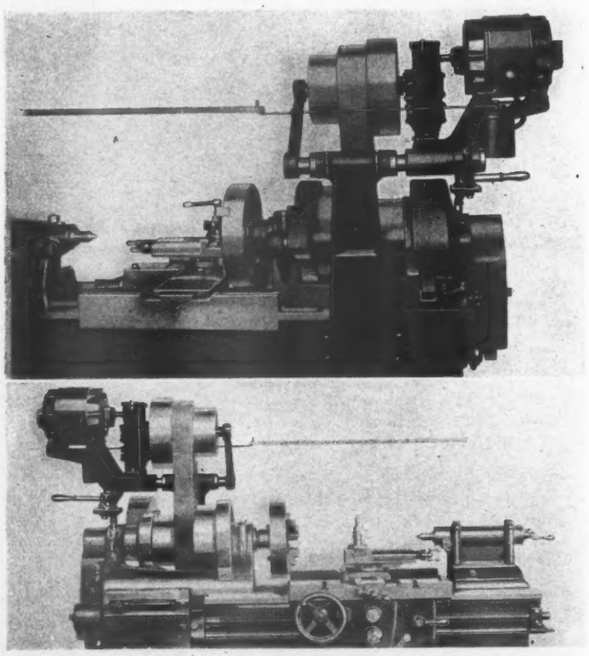
Dulux for Exterior and Interior Enameling

Dulux products for enameling are flexible when first applied and retain their flexibility over a long period of time. They are also resistant to chipping or cracking.

The enamels dry quickly, being dust free in approximately twenty minutes and may be recoated within one hour after the first application. The film is tack free in four to five hours and hard in ten to twelve hours, after which it is said to resist effectively the action of heat, alcohol, gasoline and oil.

The Cullman Lathe Drive

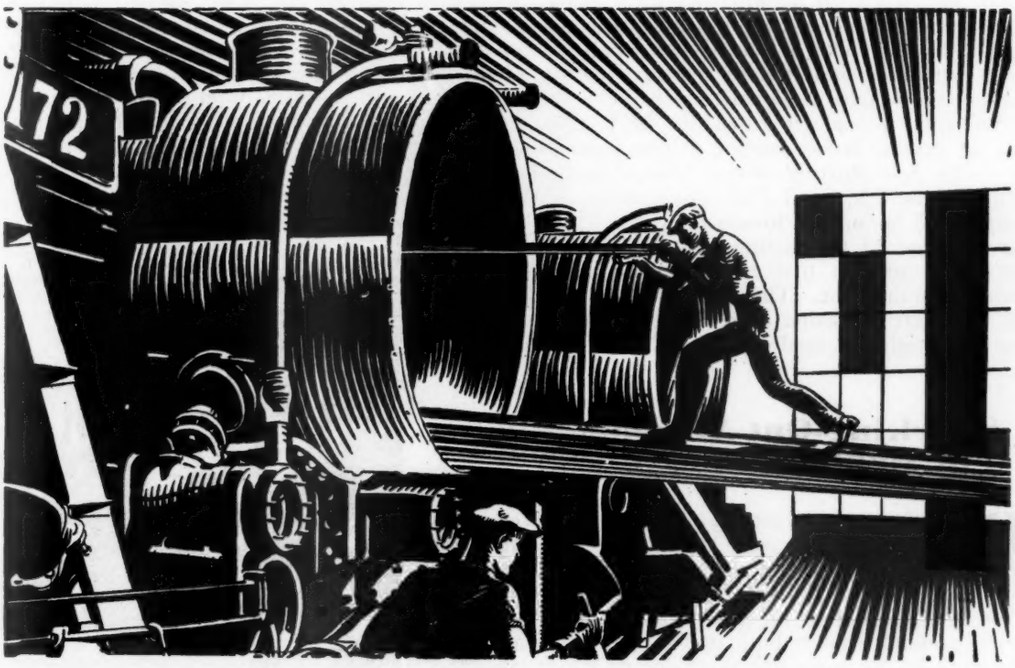
IN the illustration is shown an application of the Cullman lathe drive, an individual electric motor drive for lathes which were originally designed to be operated by means of cone pulleys and a belt. The drive, built by the Cullman Wheel Company, 1344 Altgeld street, Chicago, consists of a bracket mounted on



The application of the Cullman lathe drive for motorizing belt-driven machines

(Continued on next left-hand page)

Over twice the service from TONCAN IRON TUBES



■ Every 12 months, a certain western railroad was forced to re-tube the locomotives on a bad water division.

REG. U.S. PAT. OFF.
TONCAN
COPPER
Mo-lyb-den-um
IRON

■ Then they tried tubes of Toncan Iron. After 26 months' service, the Toncan tubes were removed, found to be in excellent condition, and re-applied to a switcher for further service.

■ By alloying refined iron, copper and molybdenum, a material of greatly improved resistance to corrosion was created. This Toncan Iron makes an ideal boiler tube. Besides resisting corrosion, it is seamless and can be readily welded. Cold-working has no effect on its corrosion resistance.

■ Tube with Toncan Iron and reduce boiler maintenance.

Central Alloy Division

REPUBLIC STEEL CORPORATION

General Offices: Massillon, Ohio

the back side of the lathe, a Cullman speed-reducing unit and drive shaft for mounting a cone pulley, a driving motor and a suitable table for mounting the various parts of the unit.

The upper end of the bracket is machined to receive a foundation shaft and is provided with clamping bolts to permit alining the bearings carrying the shaft. Two collars for side adjustments, the main bracket carrying the Cullman speed reducer with a shaft extension for mounting the cone pulley, the motor and a reversible drum switch are all mounted on the foundation shaft. A device for raising and lowering the cone pulley, to facilitate adjustment of belt tension, is also mounted on the foundation shaft together with a spring for supporting the weight when shifting the belt.

The unit is made in capacities of 1, 2, 3, 4 and 5 hp. for driving lathes ranging in size from 14 in. to 36 in. The belt shifting device lowers the cone pulley 1 in. on the 1-hp. and 2-hp. units while on the 3-hp., 4-hp. and 5-hp. units it lowers the pulley 1¼ in. On the extreme end of the raising and lowering device is an adjustable support that can be set at any convenient location on the lathe. The cone pulley which is mounted on the shaft extension driven by the speed reducer is the one originally used on the old countershaft.

Sparking-Out Attachments For Heald Grinders

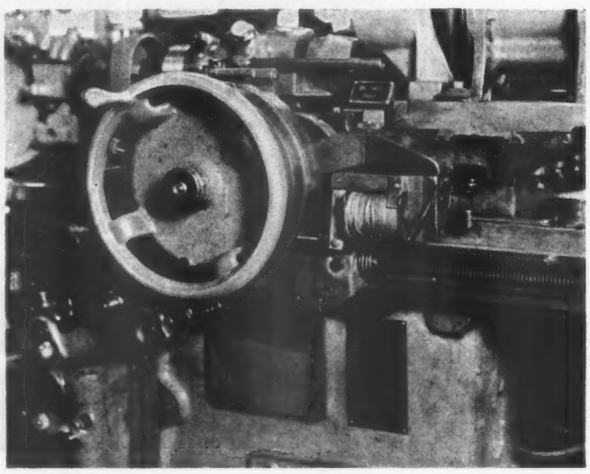
ON high precision internal grinding jobs requiring fine finish it is a well known fact that after the feed of the machine has been discontinued a certain period of time is required for the wheel to spark out. This sparking out is the natural dying out of a transverse pressure that is built up between the wheel and the work by the in-feeding function and which takes the form of a very minute spindle deflection.

Taking advantage of this condition, the Heald Machine Company, Worcester, Mass., has developed sparking-out attachments for the Gage-Matic and Size-Matic internal grinding machines which it manufactures. By automatically interrupting the cross feed and allowing sufficient time for the pressure present in the spindle to dissipate itself naturally as the wheel is reciprocated in the bore of the piece being ground, these attachments aid the machines materially in producting accurate and finely finished holes.

On the Gage-Matic, the hole is rought ground in the usual manner, the roughing gage attempting to enter the hole after each pass of the wheel until the gage does enter and cause the wheel to be withdrawn for dressing. The gage is of such size that after the work has been rough ground and the wheel has been trued, there is just enough stock left so that it will be removed by the pressure in the spindle when it is returned to the bore. The wheel, due to this pressure, then cuts itself free, bringing the hole to size and allowing the finish gage to enter which in turn causes the machine to go to rest position.

When the roughing gage enters, besides causing the wheel to withdraw for dressing, an electrical contact is made which actuates an electro magnet on the cross-slide unit, disengaging the feed pawl and holding it out of engagement with the feed ratchet throughout the finishing cycle. In other words the cross feed is automatically disengaged after roughing and the hole brought to size by the pressure remaining between the wheel and the work. The time required for the sparking out is governed by the amount of stock left in the hole after roughing and the adjustment of the truing diamond. Inasmuch as the roughing gage constitutes a definite and constant limit the amount of stock remaining can be held to a very small amount and hence the sparking out time to a correspondingly short period. An electrical connection between the coil of the magnet and the toggle switch on the control box of the machine serves to keep the magnet operative and the feed pawl disengaged until the finishing passes of the wheel have been completed and the table run out to rest position.

A micrometer diamond unit is used and it is important to note that the position of the diamond governs the finish obtainable. Moving the diamond inward trues more material off the wheel, hence the wheel goes back into the hole with a lighter pressure, and takes a larger number of passes to bring the hole to a finished size. This of course gives improved finish, and reduces



The time relay which permits the Heald Gage-Matic grinders to spark out, bringing the hole to accurate size after the cross feed has been disengaged

production in the same ratio. The converse is equally true, that is, moving the diamond outward increases the production and gives a less perfect finish.

The sparking-out attachment for the Size-Matic consists of a time relay mounted on the machine to regulate the sparking-out time, and a cam attached to the top of the fine feed cam on the handwheel to stop the feed just after the finish contact on the handwheel is made.

The machine operates in the usual manner, except that when the finishing contact is made it engages the time relay instead of tripping the table dog, and the grinding wheel continues to reciprocate in the work without feeding. After a predetermined length of time, the time relay trips the table dog, which runs out the table to rest position.

The principle of operation of the Size-Matic device is that the wheel is always trued so that its working face is a certain distance from the finished size of the part being ground. That is to say, when the wheel reenters the work after dressing, the amount of pressure between the wheel and work is always the same within narrow limits. This allows a uniform amount of stock to be removed in a given length of time after the feed is stopped.

To vary the finish obtainable with this arrangement, it is necessary to adjust both the diamond and the time

(Continued on next left-hand page)

"POWER"

The Locomotive of Tomorrow *Must have Greater Power . . .*

ONLY by using locomotives that provide this higher power economically can the earnings of railroads be raised to new high levels.

"Super-Power Principles" have so intensified power production that the simple, ten-coupled, two-cylinder locomotives recently built by Lima for the Chesapeake and Ohio Railway Company exceed the power of simple Mallets. Intensive power production in a two-cylinder unit thus reduces both operating costs and maintenance.

These latest additions to the ranks of modern power are replacing locomotives of an average age of less than ten years.

It is the railroads with the greatest proportion of such modern power that prosper.

LIMA LOCOMOTIVE WORKS INCORPORATED

LIMA LOCOMOTIVE WORKS

INCORPORATED

LIMA OHIO

relay. To improve the finish, the diamond must be moved inward, and at the same time in order for this not to affect the size, the interval of the time relay must be increased. In other words, the diamond has precisely the same effect on finish as on the Gage-Matic with sparking-out attachment. On the Size-Matic machine, however, the diamond also governs the finished size of the piece. In order to prevent the size from becoming smaller as the diamond is moved inward, it is necessary that the interval of the time relay be increased to allow a greater length of time for sparking out. This increases the number of finishing passes, and compensates for the alteration in the diamond setting. Opposite adjustments produce the opposite effect.

Unit-Cylinder Clasp Brake for Tender Trucks

THE Unit-Cylinder tender-truck clasp brake, first applied to Canadian National Locomotive No. 5700, as described in the December issue of the *Railway Mechanical Engineer* is being supplied exclusively by American Steel Foundries. It has all the distinguishing characteristics of the present standard tender-truck brake with the addition of the Unit-Cylinder feature. Two small brake cylinders are applied at the inside ends of the truck frames. The cylinders actuate levers fulcrumed to the frame, and these levers, through the medium of pull rods, transfer the power to the main truck clasp brake.

The clasp brake, itself, comprises the usual system of double vertical levers which are connected by a horizontal lever to the brake cylinder mounted on each inside corner of the truck. As shown in the drawing, both clasp brake lever systems are connected to the same brake beams.

Heavy annealed copper pipe with heavy-duty fittings is rigidly attached to the truck frame and brought over to a point as close as possible to the center plate. A flexible metallic pipe is then used to connect this pipe to the main air brake pipe which is attached to the body of the tender. This permits the truck to swivel without a "break-in-two."

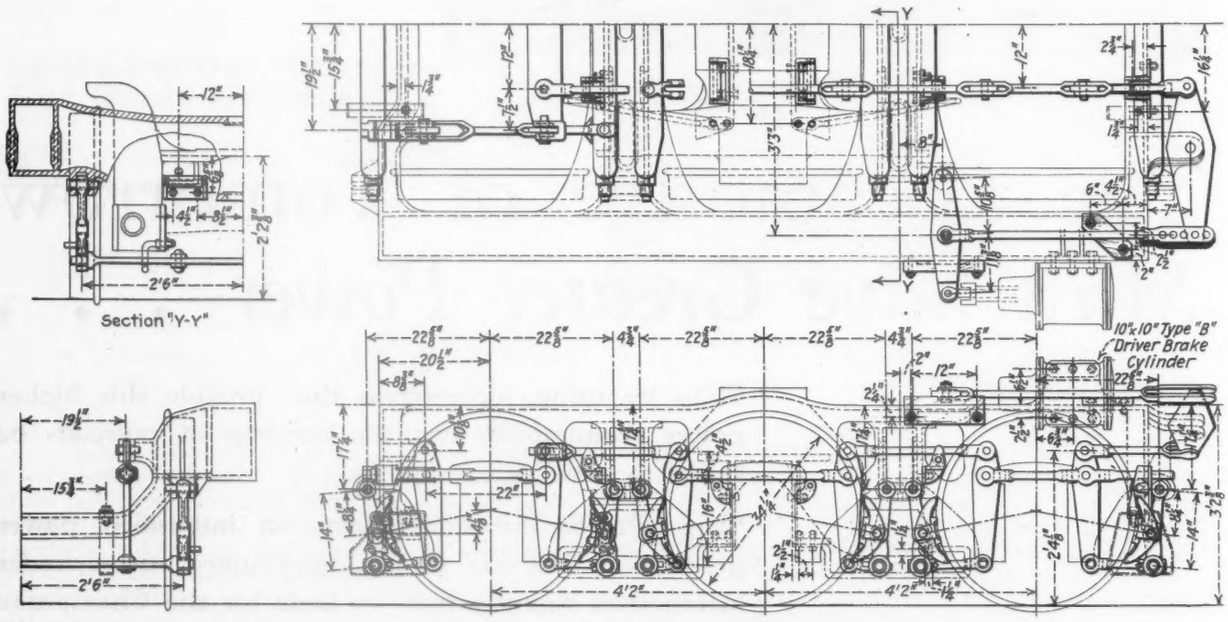
The Unit-Cylinder brake has many distinct advantages over the present tender-brake rigging, consisting of the truck brakes and the body brake, a few of the most outstanding of which will be mentioned.

The body brake is entirely eliminated, leaving that portion of the tender frame between the trucks clear for the application of stoker mechanism and other special equipment.

Trucks equipped with the Unit-Cylinder brake can be interchanged as a unit under other tenders with longer or shorter king pin centers, inasmuch as no body brake connecting rods or others affecting body conditions need be considered.

Considerable lost motion in brake rigging is eliminated with the new brake arrangement, insuring a more rapid brake application and shorter and easier stops.

On sharp curves there is a tendency toward twisting the truck levers on the usual truck and body brake application, due to the angular pull from the body brake which is supported from the tender frame. The Unit-Cylinder brake is an independent truck unit and is not affected by curves, regardless of their degree.



The Unit-Cylinder clasp-brake arrangement for tender truck applications

With the Unit-Cylinder brake, four 10-in. brake cylinders have sufficient power to brake practically any size of tender with a total ratio of 9 to 1, or under. The cylinders are easily accessible for packing renewal and more easily handled than the heavier and more bulky 16-in. or 18-in. cylinders generally used for body brakes.

A Unit-Cylinder brake has also been designed and built for application to six-wheel passenger-car trucks with an automatic slack adjuster used in conjunction with the cylinder arrangement. Here again the same advantages as on tenders are apparent, especially in the case of the elimination of all foundation brake rigging from the underside of the underframe, permitting the free use of this space for special equipment.

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LIMITED CUT-OFF SWITCHERS SAVE 25% IN FUEL . . .

New Kentucky and Indiana Terminal Locomotives are also Improving Operation by 27%

CONCERNING the new Limited Cut-Off Switchers recently placed in service, Mr. W. S. Campbell, Manager and Chief Engineer of the Kentucky and Indiana Terminal, reports:

■ "Regarding the consumption of fuel, we are showing a saving of about 25 per cent. In other words, the new engines (with larger cylinders, practically twice as heavy and double tractive effort) are consuming very little more coal than the light engines being retired."

■ In the past, standardization and low initial cost have been major considerations in switch engine purchases, rather than maximum efficiency.

■ But now progressive roads are specifying, in new switchers, the elements that have made modern road engines so efficient.

■ Among these is the Limited Cut-Off. With the Limited Cut-Off, switch engines use up to 30% less fuel, 38% less water, have a greater radius of operation, and by reason of the more uniform torque are less likely to slip, resulting in lower maintenance. The lower steam consumption makes possible the use of a smaller grate, thereby lessening standby losses and again saving fuel. They are snappier and do the job quicker.

FRANKLIN RAILWAY SUPPLY COMPANY, Inc.

NEW YORK CHICAGO ST. LOUIS SAN FRANCISCO MONTREAL

Among the Clubs and Associations

CANADIAN RAILWAY CLUB.—At the meeting of the Canadian Railway Club to be held in the York Room of the Windsor Hotel, Montreal, Canada, on February 9 at 8 p.m., the Hon. Duncan Marshall, late Minister of Agriculture, Alberta Government, will speak on Wheat and Its Relation to Canadian Farming.

NEW ENGLAND RAILROAD CLUB.—J. J. Pelley, president of the New York, New Haven & Hartford, will address the members of the New England Railroad Club at 6:30 p.m. on February 18 at the Copley-Plaza Hotel, Boston. It is expected that the presidents of all the New England railroads will be present at this meeting.

CLEVELAND RAILWAY CLUB.—The Cleveland Railway Club will hold its next and succeeding meetings at the Auditorium in the Brotherhood of Railroad Trainmen's building, West Ninth street and Superior avenue, Cleveland, Ohio. The time of meeting has also been changed from the first Monday to the second Monday of each month, the next meeting being on February 9 at 8 p.m. when there will be a continued discussion of the 1931 A.R.A. mechanical rules.

CINCINNATI RAILWAY CLUB.—Armco night will be the feature of the February 10 meeting of the Cincinnati Railway Club which will be held at 6 p.m. at the Roof Garden of the Hotel Gibson, Cincinnati, Ohio. J. P. Butterfield, assistant manager, development department, American Rolling Mill Company, Middletown, Ohio, will present a paper on the continuous mill process, illustrated by motion pictures. Musical entertainment and dinner will also be furnished.

SAINT LOUIS RAILWAY CLUB.—"How the Department of Agriculture of Illinois, through Its Division of Standardization and Markets, Aids the Railroads in Assisting the Farmers To Prepare Their Commodities for Shipment" will be the subject of a paper by Joe W. Cummins, chief inspector of the Division of Standardization and Markets, to be presented before the meeting of the Saint Louis Railway Club which will be held on Friday evening, February 13, at the Statler Hotel, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—At the February 12 meeting of the Central Railway Club of Buffalo, which will be held at 8 p.m. at the Hotel Statler, Buffalo, N. Y., two papers will be presented as follows: The Effect of Machinery on Maintenance of Way Organization and Work, by Robert Faries, assistant chief engineer, Pennsylvania Railroad, Philadelphia, Pa., and The Ideal of a Perfect Performance, by T. H. Carrow, superintendent of safety, Pennsylvania Railroad, Philadelphia, Pa. Entertainment will be furnished by the Red Arrow Quartet.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—The new A.R.A. rules will be discussed at the meeting of the Car Foremen's Association of Chicago which will be held at the Great Northern Hotel, Chicago, at 8 p.m. on February 9. ¶ The meeting held at the Great Northern Hotel on Monday evening, January 12, was devoted entirely to a discussion of the new A. R. A. rules of interchange. Nearly 300 members of the association were present and, as usual, the argument regarding different points of some of the rules was quite heated. The discussion at that meeting proceeded as far as Rule 32.

CAR FOREMAN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—A paper on the Removal and Application of Wheels will be presented by N. A. Johnson, car foreman, Chicago, St. Paul, Minneapolis & Omaha, at the meeting of the Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange to be held at 2 p.m. on February 12 at Omaha, Nebr. ¶At a banquet, which was held on January 24 at the Chieftan Hotel, Council Bluffs, M. P. Schmidt, organizer of the Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange, was the guest of honor. Officers of various roads spoke of their acquaintance with Mr. Schmidt, who is general car foreman of the Chicago, Milwaukee, St. Paul & Pacific, and commended him for his good work in organizing the association which has brought about the expediting of cars through the interchange in a most economical and efficient manner. J. C. Rowe, superintendent of the Armour car shop and chairman of the entertainment committee, acted as toastmaster, and J. E. Mehan, assistant to the superintendent of the car department of the St. Paul, gave a talk on the loyalty and service which Mr. Schmidt has rendered to that road during his 48 years of service. Mr. Schmidt gave his reasons for starting the association and in his talk contrasted the discord existing at that time and the spirit of co-operation which now exists among the various foreman at Council Bluffs. The association was founded 30 years ago.

* * *

A Pennsylvania Decapod

FOURTH NATIONAL FUELS MEETING.—On Friday afternoon, February 13, at the Hotel Stevens, Chicago, a smoke abatement conference will be held in conjunction with the Fourth National Fuels meeting and Midwest Power conference. Experts in the efficient use of fuel for the development of power will assemble from all parts of the country and be available for advice in connection with smoke abatement work. John Hunter, consulting engineer, St. Louis, Mo., will preside at the smoke abatement conference, in the course of which papers will be presented on various important phases of smoke abatement activities, both in this country and abroad. The contribution of the railroads to air pollution by means of smoke will also be discussed, and railroad men will be invited to attend the conference and take an active part in the solution of this pressing modern problem.

Club Papers

Air Conditioning

Western Railway Club.—Meeting held at Hotel Sherman, Monday evening, January 19. Paper on the Effect of Air Conditioning upon Human Beings, by L. L. Lewis, secretary, Carrier Engineering Corporation, Newark, N. J. ¶ In presenting his paper Mr. Lewis discussed fully the effects of air conditioning on the human body and showed a number of lantern slides indicating the relation of many variables which must be considered in the solution of the heating and ventilating problem. ¶ Following Mr. Lewis, F. A. Isaacson, engineer of car construction, Atchison, Topeka & Santa Fe, discussed the application of the Carrier air-conditioning equipment on a Santa Fe dining car, and A. E. Voight, car lighting engineer, described the pro-

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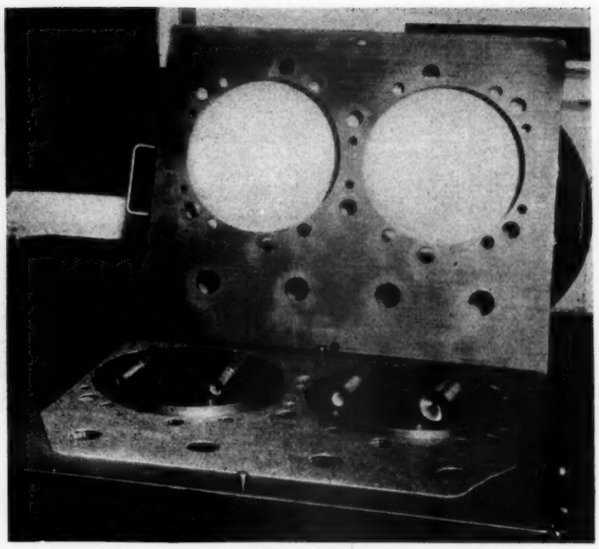
Punch press and dies used in making clamps for copper pipes



Gasoline-engine cylinder-head gasket cutting device

shops of the North Western, on the same punch press as that used in making the guide liners, is the manufacture of small clamps used in securing copper pipe to a locomotive jacket by means of Parker-Kalon screws. These clamps, shown at *A* in one of the illustrations, are made of No. 18 gage sheet steel, being provided with a semi-circular recess to accommodate the pipe and with two holes punched to receive the screws.

The small dies used in this case are secured to the base plate and to the top header plate in the usual manner, being designed so that the two progressive operations required are performed one after the other and a clamp turned out for each stroke of the machine. Sheet steel strips of the proper gage and width are simply fed to the machine, the first stroke forming the half-round recess in the clamp and the second punching the two holes and shearing the half round ends all at one time. Each subsequent stroke of the machine, therefore, performs the first operation on one clamp and the second operation on another. A production of four to five thousand clamps in eight hours is secured.

Gasket-Cutting Device

A considerable amount of gasoline-electric rail equipment is now in operation on the Chicago & North Western and, whenever necessary, for any reason, to remove the engine heads, new gaskets are usually applied. These gaskets, made of a composition material, were formerly purchased new from the manufacturer, but are now made at Chicago shops. Inasmuch as the relatively small number of gaskets used prohibited the making of expensive dies for the operation, the comparatively simple gasket-cutting device, illustrated, was devised, which permits the railroad to make its own gaskets with a total saving, including labor and material, of 75 per cent.

The device consists of two ¾-in. steel plates, planed down to a true surface on one side of each plate only, and provided with two locating pins and corresponding holes so that when the upper plate is placed on the lower it always takes exactly the same relative position. For convenience, the upper plate is provided with two handles to be used in removing or applying it. Both of these plates are laid out and drilled for the various port and bolt holes required. Two large holes in the upper plate, corresponding to the cylinder bores, are an accurate sliding fit on the two flat cylindrical pieces pressed into the cylinder bore holes in the bottom plate of the device. Four punches, of the various sizes required, are made to be an accurate sliding fit in the small holes and are ground concave on the ends, as illustrated.

The first operation in making the gaskets is to cut the material or packing to the proper size on squaring shears in the tin shop. A templet is then applied to locate the cylinder centers, a trepanning tool being used to cut out circular sections of the packing corresponding to the cylinder bores. The gaskets are then placed over the cylindrical projections corresponding to the cylinder bores in the bottom plate, and the top plate is lowered in place, being positioned accurately by the locating pins and cylinder bore holes mentioned. The weight of the upper plate holds the packing in place while the small punches are being used to cut out necessary holes in the packing. One blow on the punch with a wooden mallet is sufficient to make a clean, accurately located hole. After all of the holes have been punched, the top plate is removed and the gasket is found to be smoothly and accurately cut. The production is about 75 gaskets in eight hours. Gasket-cutting plates of this type have been developed for the various sizes of gasoline engines now used on the North Western and, owing to the simplicity of the device, only a relatively small investment is involved.

Globe Valve Tester

The modern locomotive requires for its successful operation an increasing number of valves of different types, perhaps the simplest of which is the ordinary globe valve. These valves must, to a greater extent than ever before, stand high pressures, operate easily and be tight. To assure the existence of these qualifications, all valves on general repair locomotives at the Chicago shops of the North Western are taken to the brass room on the balcony, thoroughly overhauled and tested in the device illustrated. This is simply a quick and convenient means of putting a water test on the valves without the labor of screwing them onto the test line.

The device is mounted on a bench adjacent to the

Modern Universal tool-room miller machining a keyway or groove in a signal equipment part

steel compartments where valves awaiting repairs and those overhauled are located. The device comprises a base plate through which the shop air pipe passes and on which the valve rests, being held in place by a cross bar attached to the plunger of a small air cylinder. The latter is supported, as shown, on two 1-in. studs threaded into the base plate of the device. A three-way valve, with suitable handle, provides for the supply and exhaust of air to and from the cylinder. False seats, provided with leather gaskets, are available for use with valves of different sizes.

In operation, therefore, a false seat of the required size is placed in the testing machine and the valve held on this false seat, while the air pressure is applied and the plunger comes down to hold the valve firmly against the 90 or 100 lb. usually carried in the shop air line. The cavity in the upper part of the valve is then filled with water and air pressure applied from the underside, any leak in the valve being immediately apparent by the passage of air through the water. The simplicity of this device gives no measure of its effectiveness, as will be appreciated by anyone who has ever tried to test valves by screwing them on to a test line, or possibly permitting defective valves to go back to the locomotive, give trouble and have to be removed for repairs after being applied.

A similar device, with only slight necessary modifications, has been developed for the testing of angle valves.

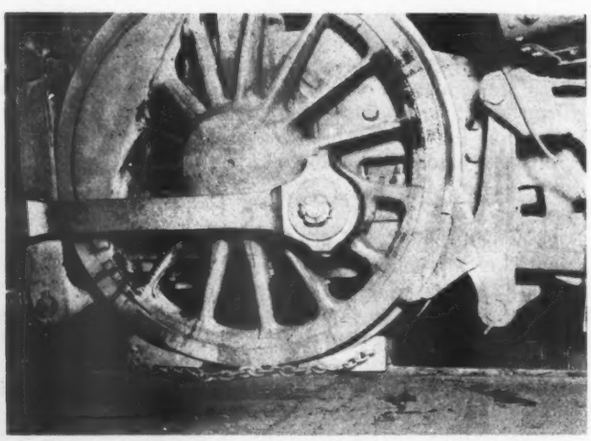
Simple device which saves labor in testing globe valves

Tool-room Miller

A machine which is giving a very good account of itself in the tool-room of the Chicago shops of the C. & N. W. is the Brown & Sharpe No. 3A universal miller, illustrated. This illustration shows the machine being used in conjunction with a B. & S. dividing head for machining the odd-shaped keyway, or groove, in a lock plunger forming part of the signal equipment. This use simply serves to indicate the wide variety of operations which a railroad tool-room miller is sometimes called upon to perform, and for which the universal miller is well adapted. This milling machine is notable for rigidity, accuracy and ease of operation, quick return of the table and the work being provided in all directions. The machine is used mostly for the manufacture of special helical milling tools, and taps, which cannot be bought in the open market. Special seating tools for line check valves, angle valves, injectors, etc., are also made on this machine, as well as forming and blanking dies, and all jig work requiring accuracy. High-speed steel cutters are employed so that the operations can be carried out with a minimum loss of time, and the machine is designed to stand the cutting feeds and speeds encountered in this type of operation.

Forged Steel Chock Blocks

IN the illustration is shown an effective set of chock blocks for use as a safety measure under the wheels of locomotives standing under steam. They are



Chock blocks of forged steel with faces machined to fit the contour of driving tires can be used effectively to hold locomotives standing under steam

12 in. long, 5¾ in. wide and 5½ in. high at the heel and, thus, are higher and thicker than the ordinary wooden wedge used for this purpose. After the forging is made, the face of the block is machined to a radius of 26 in. and to fit the contour of the tread of the driving-wheel tire with a recess for the flange. The bottom of the block is slotted to a width of 3½ in. to fit over the top of the rail. Two ½-in. tool-steel pins

are pressed into the face of the slot near the heel of the block, with only the points projecting, thus increasing the friction between the block and the rail should the driving wheel run up on the block. A 15/16-in. hole is drilled through the block at its thickest point for the insertion of a 7/8-in. eye-bolt. Two blocks are joined together by a short length of chain which is attached to the blocks by means of the eye-bolts.

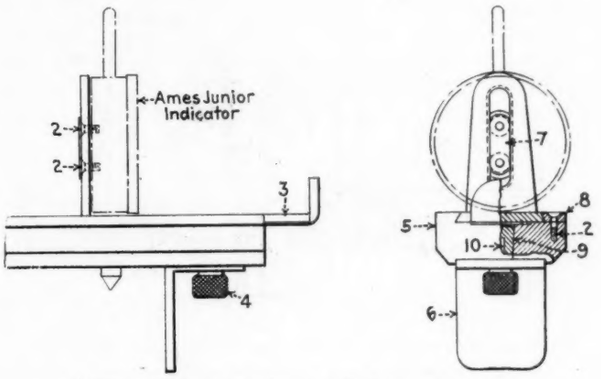
During a test which was made to determine the effectiveness of the blocks, the wheels of a locomotive failed to mount them, the drivers spinning on the rail which resulted in moving the blocks a distance of 2 in. The driving wheels, rolling on the radial faces of the blocks, imbeded the small tool-steel pins in the face of the rail, thus preventing the blocks from slipping.

Bushing Fixture For Ames Indicator

THE fixture or mounting, the assembly and details of which are shown in the two drawings, is used in connection with the Ames Junior indicator, manufactured by B. C. Ames & Company, Waltham, Mass. It is used in the air-brake repair department and tool rooms of an eastern railroad primarily for checking bushings. It is standard practice in the air-brake department on this road to true bushings that vary in excess of .001 in.

The numbered parts on the detail drawing refer to the numbers shown on the assembly drawing. The indicator is secured to the vertical arm of the indicator slide (3) by means of the screws (2) and the block (7). A slot in the indicator slide permits adjusting for height. The indicator slide is machined to fit the grooves in the top of the base (5), and is held in place by the gib (8), which is secured to the base by three machine screws, countersunk as shown. The bracket (6) is machined to slide in the groove on the bottom of the base (5) for purposes of adjustment. The thumb screw (4) screws in the taper block (9), which can be moved to any position desired in the slot in the center of the base (5). Two dowel pins (10), machined for a loose fit in the two 1/8-in. holes in the block (9) are riveted to the top horizontal arm of the bracket (6).

The contact point of the indicator should extend below the base as shown on the assembly drawing. Work to



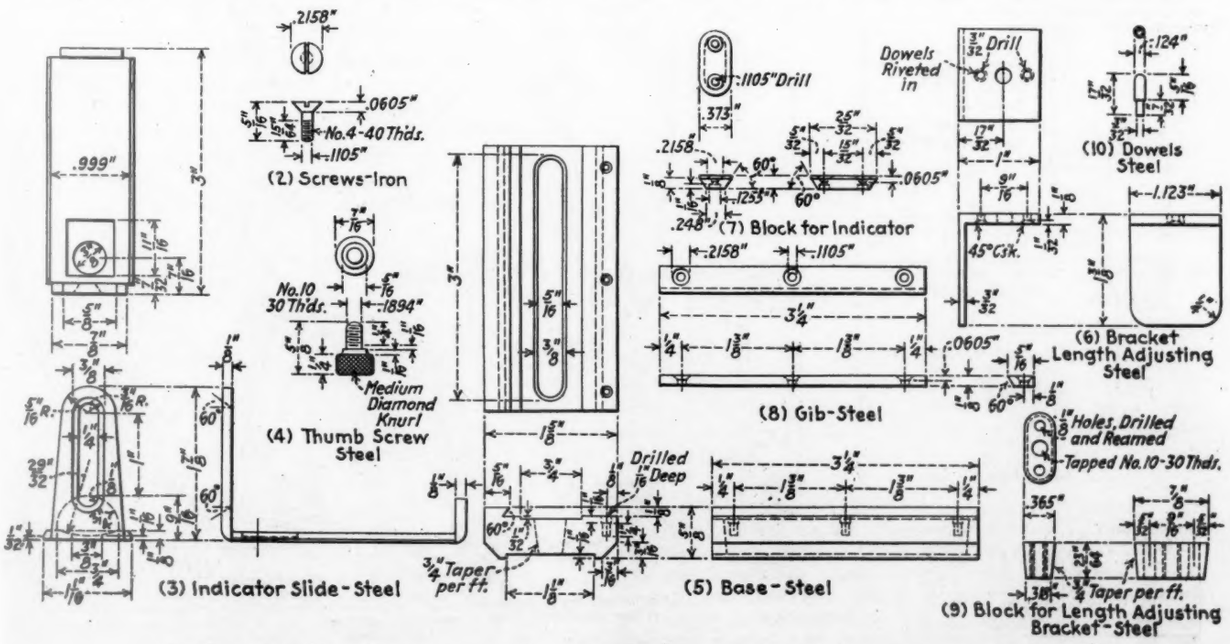
Ames Junior indicator applied to the fixture

be checked is placed on a flat-finished surface plate in the usual manner, using the vertical leg of the bracket as a rest for the fixture.

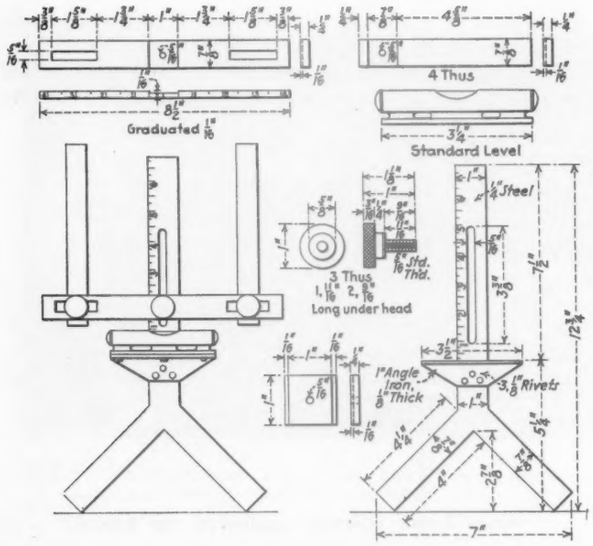
Gage for Setting Up Crossheads

THERE are a number of methods in common use for setting and alining the top crosshead guide after the bottom one has been bolted in position. One method in practice on an eastern road makes use of the common gage shown in the drawing.

The gage consists of a base, the legs of which are set at an angle of 90 deg., a section of 1-in. angle iron, a standard 3-in. level and a graduated scale, all riveted together to form an integral piece. A cross bar, graduated in sixteenths of an inch, is attached to the graduated scale by an 11/16-in., knurled-head bolt which is



Details of the fixture used in connection with the Ames Junior indicator for truing bushings



A leveling gage for adjusting the top guide when setting up crossheads

used to adjust the cross bar vertically in a 3⅜-in. slot cut in the scale. Two vertical pieces of ⅞-in. by 1/16-in. sheet steel are fitted in small slots at each end of the cross member by means of 9/16-in. knurled-head bolts.

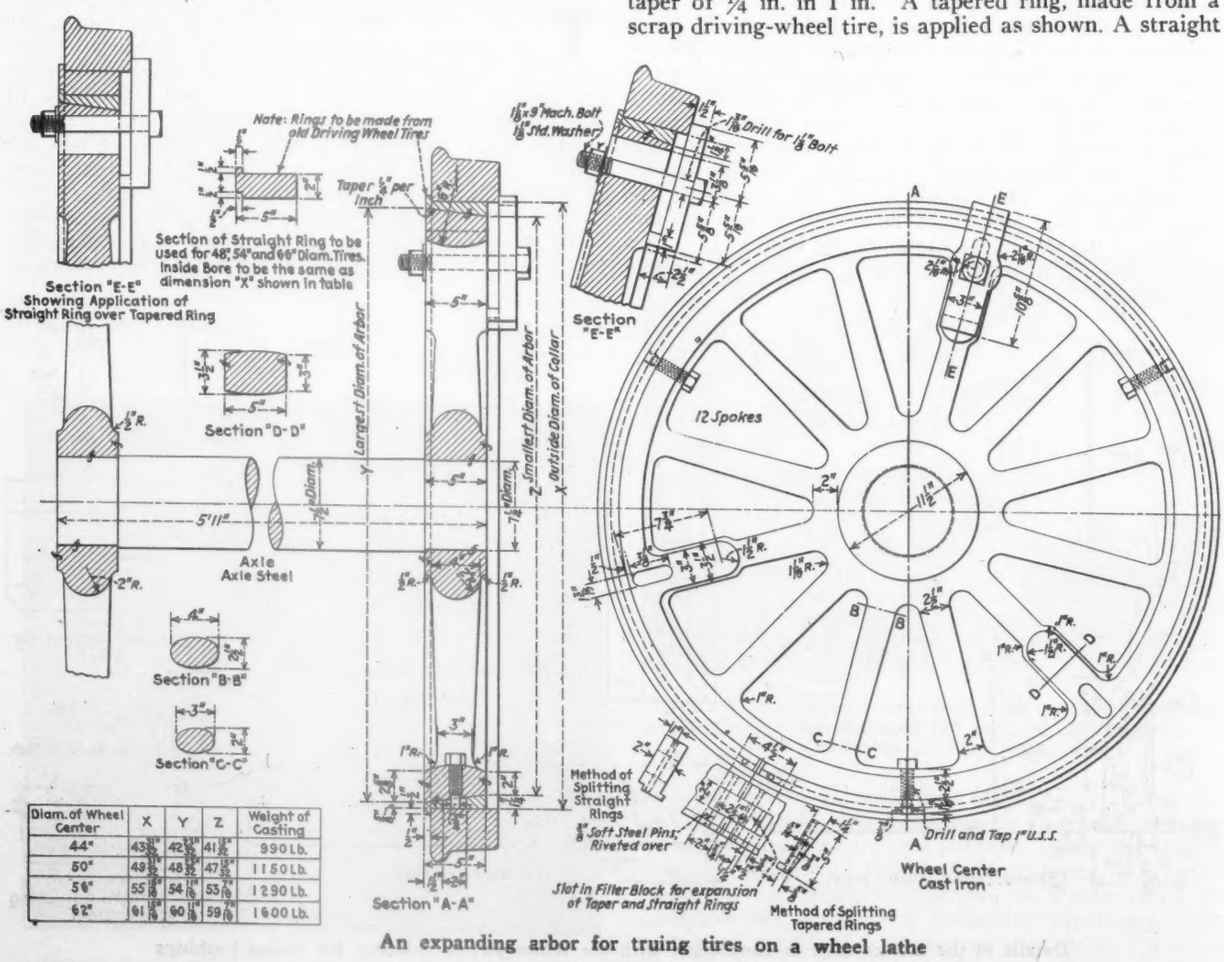
When in use, the vertical members are adjusted horizontally so that the distance between their inside edges is the width of the face of the guide. The cross member is then adjusted vertically after the crosshead has been calipered to determine the distance between the guides.

When the top guide is temporarily applied, a small scale can be set face to face with the vertical graduated scale of the gage to determine what thickness of liner is necessary under the guide to give the crosshead the proper clearance after it has been set up.

When the liners are made and applied, the gage is placed on the bottom guide, which has been set and alined by the usual method of centering a string in the cylinder and extending it back past the guide yoke. As the gage is set at various places on the lower guide and leveled, the top guide is brought into a position which will bring its face between the vertical members of the gage. When the face of the top guide sets between the vertical members of the gage, requiring no further adjustment, temporary bolts are applied, preparatory to reaming the holes for the application of the guide bolts.

Expanding Arbor for Turning Tires

THE expanding arbor shown in the drawing is designed for turning unmounted tires on a wheel lathe. The wheel center is of cast iron and has 12 spokes, three of which are cast and cored as shown at sections *D-D* and *E-E* for 1⅛-in. by 9-in. clamping bolts. The rim of the wheel center is machined with a taper of ¼ in. in 1 in. A tapered ring, made from a scrap driving-wheel tire, is applied as shown. A straight


Note: Rings to be made from old Driving Wheel Tires
Taper ¼" per inch
Section of Straight Ring to be used for 48", 54" and 66" Diam. Tires. Inside Bore to be the same as dimension "X" shown in table
Section "E-E" Showing Application of Straight Ring over Tapered Ring
Section "D-D"
Axle Steel
Section "B-B"
Section "C-C"
Section "A-A"
Section "E-E"
12 Spokes
Method of Splitting Straight Rings
Soft Steel Pins Riveted over
Slot in Filler Block for expansion of Taper and Straight Rings
Method of Splitting Tapered Rings
Drill and Tap 1" U.S.S.
Wheel Center Cast Iron

Diam. of Wheel Center	X	Y	Z	Weight of Casting
44"	43	42	41	990 Lb.
50"	49	48	47	1150 Lb.
56"	55	54	53	1290 Lb.
62"	61	60	59	1600 Lb.

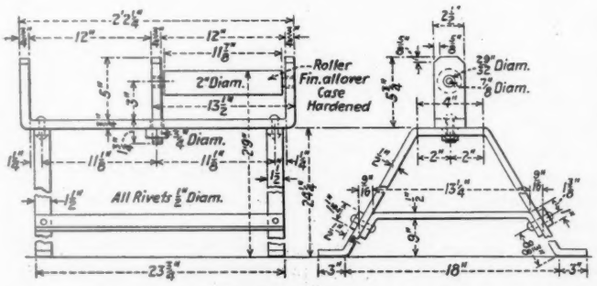
An expanding arbor for truing tires on a wheel lathe

ring can also be used when the inside diameter of the tires require additional diameter for the arbor. Both the tapered and straight arbor rings are split, and a slotted filler block is provided to allow for expansion of the rings. Three 1-in. bolts, turned down to ⅞-in. diameter 1¼ in. from the end, are spaced equidistant around the wheel center to prevent the rings from slipping off. Two-inch holes in the rings allow sufficient free movement of the rings to facilitate the application and clamping of the tires in position.

Tightening the nuts on the three clamping bolts causes the tapered ring to expand around the wheel center and thus clamp the tire in position for turning.

Feed Stands for Use with Power Shears

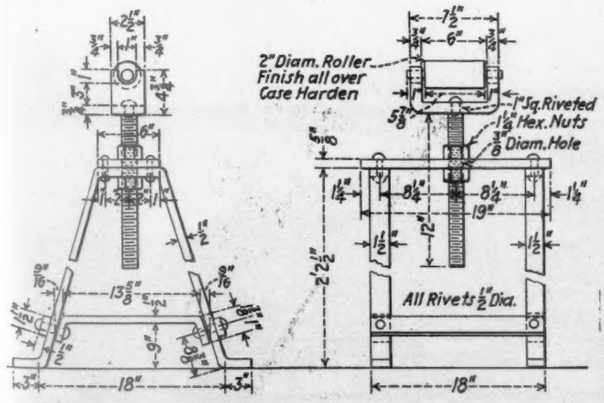
IN the two drawings are shown feed stands which are designed to facilitate the feeding of large and small bars of iron and steel to sheers during production cutting operations. One of the stands consists simply of a 2-in. roller inserted in a yoke, riveted to one end of a 1¼-in. by 12-in. threaded bar which is supported on the stand by two jam nuts. The nuts may be loosened and the



A roller-feed stand designed with a rack which expedites the production cutting of small bar stock

bar raised or lowered to any desired elevation; after which they are tightened against the stand, rigidly holding the roller in its set position. The stand supporting the roller is 18 in. wide, 19 in. long and 27⅛ in. high. The legs and braces are constructed of ½-in. by 1½-in. slab iron, while the top, through which the threaded bar extends, is made of ⅝-in. by 6-in. plate.

The other stand is a combined feed stand and rack



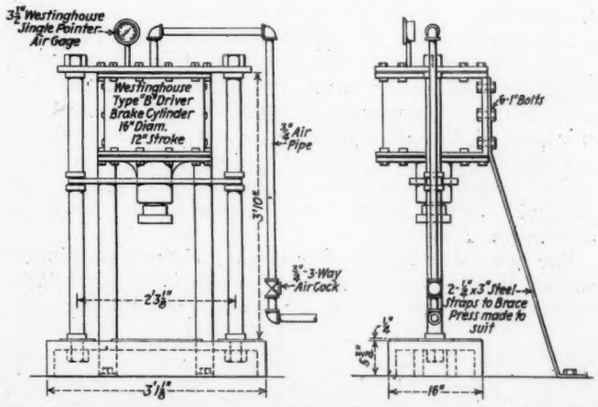
A single roller mounted on a stand to facilitate the feeding of heavy bar stock to a power shear

and is designed primarily for feeding small bar stock to the shears. There is no provision made for elevating or lowering the roller of this stand which is 2 ft. 9 in. above the floor. The stand is made of sufficient strength to permit the storing of a quantity of stock beside the roller, one end of the plate forming the top of the stand being flanged up to prevent the bars from rolling off. The stand is constructed of ½-in. by 1½-in. slab iron and is 18 in. wide and 23¾ in. long.

Pneumatic Press for Valve-Motion Bushings

IN shops where considerable rod work is done for locomotives in adjacent enginehouses in addition to the regularly scheduled back-shop work, hydraulic bushing presses are often worked at maximum capacity. This, in many instances, is detrimental to the progress of smaller work through the shop such as the pressing of bushings in various valve-motion parts. Again, it is not always desirable to operate a large hydraulic press for such light work.

The pneumatic press shown in the drawing is especially adaptable for light work. The press, which is 3 ft. 10 in. high and set on a 3-ft. 1⅛-in. by 16-in. by 5¾-in. cast-steel base is designed to be mounted on a work bench and consists of a Westinghouse 16-in. by 12-in. driver-brake cylinder mounted between and near the tops of two 2½-in. by 4-ft. 5-in. round steel rods. The rods are threaded top and bottom, at the top for the application of a horizontal cross brace and at the bottom for bolting them to the cast steel base. A second horizontal cross brace is placed below the cylinder while


Westinghouse Type "B" Driver Brake Cylinder 16" Diam. 12" Stroke
Air Pipe
3-Way Air Cock
6-1" Bolts
Straps to Brace Press made to suit

A pneumatic press for small bushing work which can be mounted on a work bench

two ¼-in. by 3-in. steel straps are bolted to it and to the work bench for supporting the assembled press. In view of the fact that the press is mounted on a work bench the air-operating valve is situated in a position near its base.

FIFTY YEARS AGO.—Freight business on most western railways is now immense, and every wheel is needed to dispose of the rush of agricultural products and merchandise. Lack of cars and locomotives represents the greatest complaint. The shops are crowded with orders for new equipment, some roads are leasing locomotives and cars from others, passenger engines are pressed into freight service, and practically all machinery is compelled to do double duty.—Railway Age, August 5, 1880.

NEW DEVICES

Water Conditioner Tests

THE Locomotive Water Conditioner, developed jointly by the Bird-Archer Company and the Chicago, Milwaukee, St. Paul & Pacific, under the direction of R. W. Anderson, general superintendent of motive power, was first applied to the Mikado-type locomotive, illustrated, about two years ago. From a descriptive article, published on page 165 of the March 1930 issue of the *Railway Mechanical Engineer*, it will be recalled that the principal objectives sought in the development of the device were simplicity, relatively low cost, low maintenance, feedwater heating, storage of hot water, feedwater treatment and removal of oxygen. It is too early yet to say to what extent all of these objectives will be attained under all conditions of service. The first three are more or less inherent in the design. There is no question about the hot water storage feature, and tests indicate that an average feedwater temperature of 208.6 deg. F. is readily attainable, as well as an average oxygen elimination in excess of 82.4 per cent. The success of service tests of the device on the Milwaukee to date are such that, besides the two light and heavy Mikados already equipped, five additional installations are now being made, including one on a converted 2-6-6-2 type locomotive.

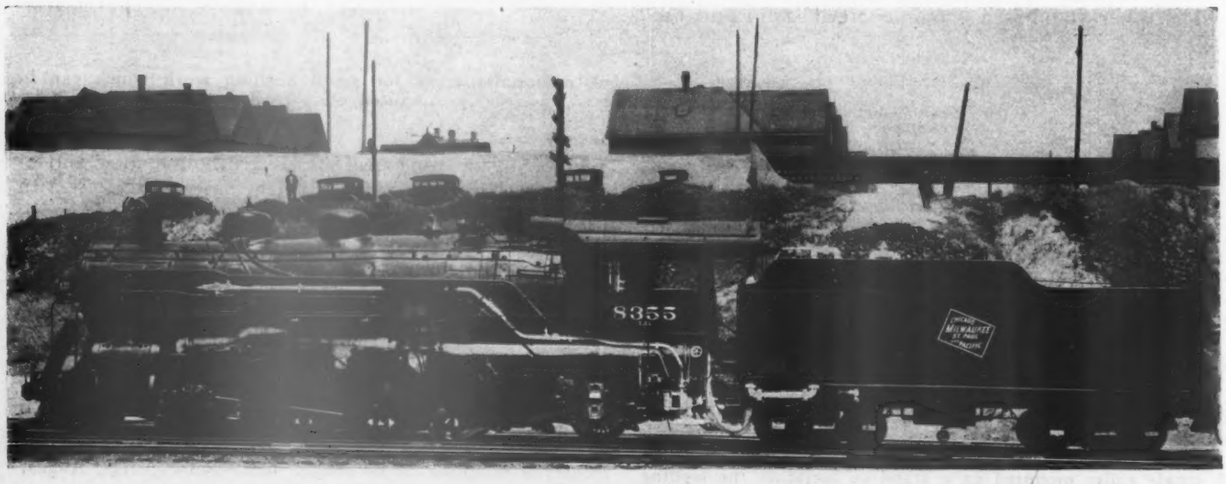
A number of important improvements have been made since the Locomotive Water Conditioner was first described in the *Railway Mechanical Engineer*, the principal ones being the application of an exhaust steam ejector to replace the small turbine-driven pump for supplying cold water from the main tank to the hot water storage compartment; and the development of an improved, turbine-driven, feedwater pump unit which will take hot water and deliver it efficiently and reliably against high boiler pressures. This pump was described on page 719 of the December issue of the *Railway Mechanical Engineer*.

The general principle of operation of the Conditioner has not been changed. Exhaust steam is brought back from the cylinders through a 6-in. pipe to heat the water in one leg of the tank which has been partitioned off to form a hot-water storage compartment of 700 gal. capacity, or more, dependent upon the needs. The temperature of water in this compartment is held uniformly at or near the boiling point, as long as exhaust steam is available, by means of a thermostatically-operated exhaust-steam control valve. A fixed water level is maintained in this compartment, as long as the locomotive is in operation, by means of a float which operates through a Crane butterfly valve to control the supply of steam to the ejector. When the locomotive drifts or stops, this supply of stored hot water may be drawn upon to feed the boiler through the boiler feed pump. The design is thus adapted to assure the full benefits of feedwater heating, not only to road locomotives, but to yard, switch, transfer and other locomotives in intermittent service.

Feedwater Temperature Maintained in Excess of 140 Deg. F.

An ingenious and effective device is provided to prevent the possibility of injecting cold water into the boiler at any time, whether the locomotive is working or not. Should any attempt be made to start the boiler feed pump when water in the storage compartment is at less than 140 deg. F., high-pressure steam is admitted to the water at the pump suction under the control of a thermostatically-operated live-steam valve. Just as soon as exhaust steam is available to heat the water in the compartment above 140 deg., the live-steam valve automatically closes.

As a result of the above provision in the design of the Conditioner equipment, its operation has been rendered as nearly automatic as possible, boiler feeding being reduced to its simplest form, or, in other words, a one-valve operation, with the equipment available for use at all times. The boiler feed pump steam valve in the cab is the only one requiring the attention of the engine crews, all other valves in the equipment being entirely automatic in action and of rugged construction, designed to give reliable service over a long period, under exacting conditions. The thermostatic control, required on only two of the valves, consists of a thoroughly-tested



C. M. St. P. & P. locomotive on which the Water Conditioner was tested

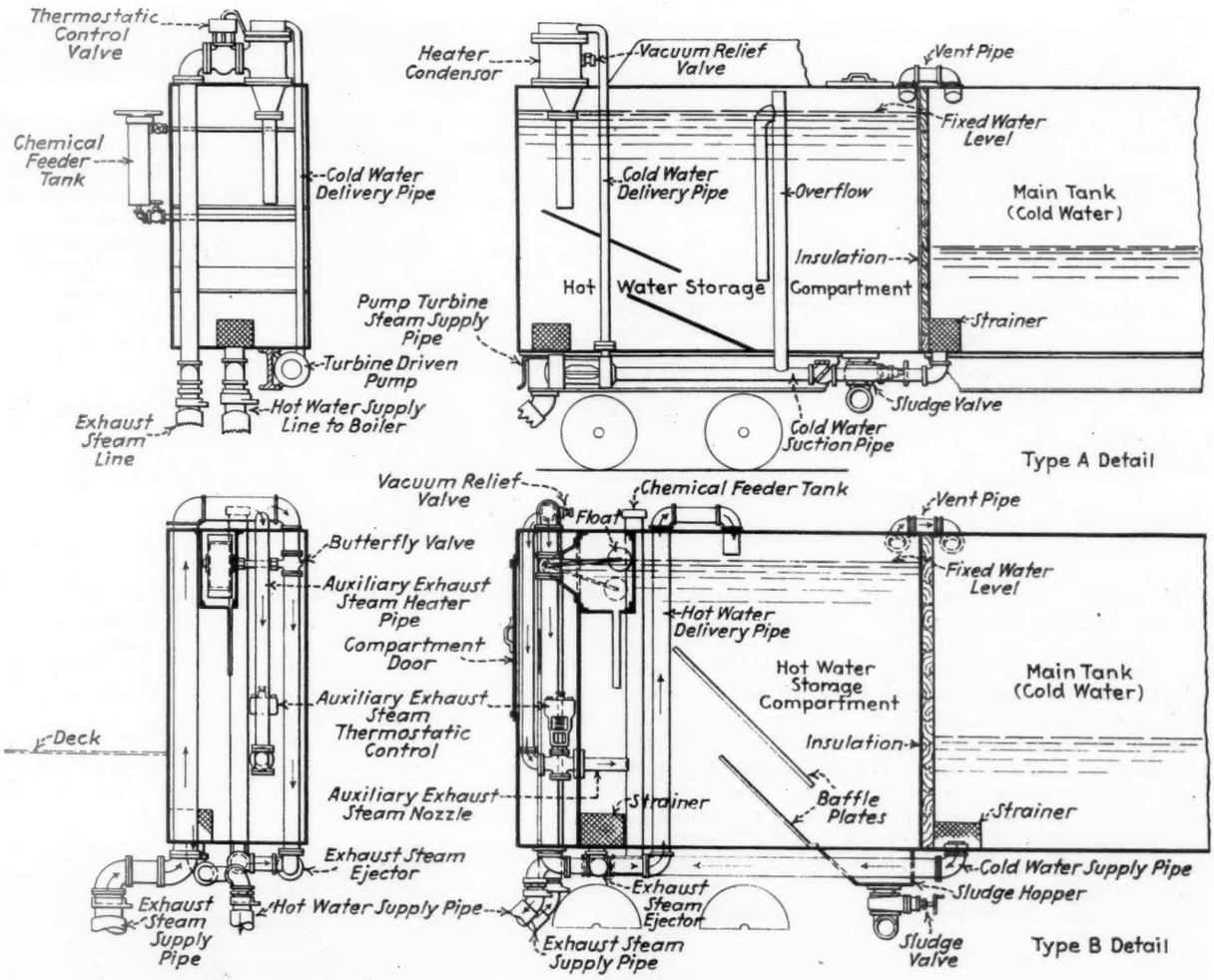
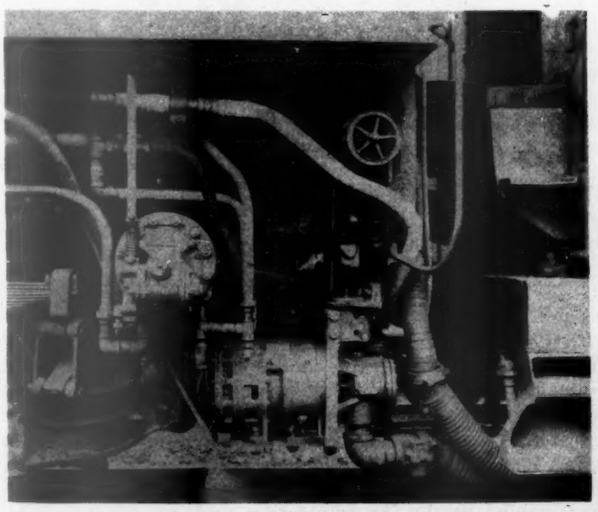


Diagram showing construction of the Type A and the Type B Conditioners as applied to the left water leg of a tender tank

design, especially adapted for use with this equipment by the Fulton Company, Knoxville, Tenn.

Chemical treatment of the water is secured by the insertion of briquettes of the necessary chemical composition in a cylindrical container with removable cap, located on the left water leg of the tank, and connected to the cold-water delivery pipe, as illustrated in the drawing. Cold water, carrying the proper amount of the required chemical solution, then passes to the cold-water delivery line, mixes with exhaust steam in the heater condenser and is delivered to the hot water storage compartment where the chemical reaction is greatly speeded up, owing to the high temperature. Any scale-forming impurities or free mud which settles in the bottom of the compartment can be readily discharged at terminals through the sludge valve, illustrated.



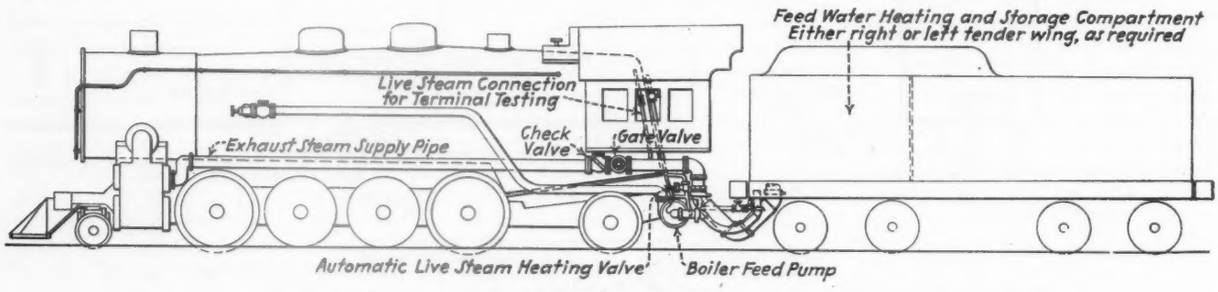
Details of the feed pump and piping application

Two Types of Water Conditioners

Referring to the diagram, it will be noted that the Locomotive Water Conditioner is now available in two types, Type A employing a turbine-driven pump for supplying cold water to the storage compartment, and the Type B employing an exhaust steam ejector for this purpose. In the latter case, cold water flows by gravity to the ejector, where exhaust steam, drawn from the main cylinders, combines with the water and forces it through the hot water delivery pipe to the storage compartment. The heating of the water in the Type B Conditioner is thus accomplished in two stages; first, in the ejector, and, second, by the admission of exhaust steam through the thermostatic control valve directly

in the hot water storage compartment. The ejector is wholly automatic in operation.

Throughout the development period of the Locomotive Water Conditioner on the Milwaukee, the temperature of the water entering the boiler has been closely observed on numerous tests. In addition, test records of temperature and oxygen removal have been made by Dr. D. H. Koyl, water service engineer of the railroad. Doctor Koyl's report shows that on one test run an average temperature of 208.6 deg. was obtained with an average oxygen removal of 89.8 per cent. Twenty-four temperature readings were taken on this occasion and 12 oxygen determinations made of the water that passed through the Conditioner. An average of three tests of this nature showed, however, an average oxygen elimination of 82.4 per cent. The device has been operated without extra labor costs, other than ordinary maintenance, and the cost of the chemicals required for the treatment of the water evaporated. Locomotives equipped with the Conditioner have been successfully operated in territory where both treated and untreated waters, as well as mixtures of the two are handled.


Feed Water Heating and Storage Compartment
Either right or left tender wing, as required
Live Steam Connection for Terminal Testing
Exhaust Steam Supply Pipe
Check Valve
Gate Valve
Automatic Live Steam Heating Valve
Boiler Feed Pump

Piping diagram of a Water Conditioner application

Pease Junior Model Print Dryer

THE Pease Junior Sheet Dryer, manufactured by The C. F. Pease Company, 813 North Franklin street, Chicago, is designed for the drying of moderate sized blue-prints, negatives, blue-line and brown-line prints up to 24 in. wide. Also, when a chromium-plated cylinder is used, it is particularly adapted for drying photo prints. The Junior Model Dryer closely resembles the larger size Pease dryers in design.

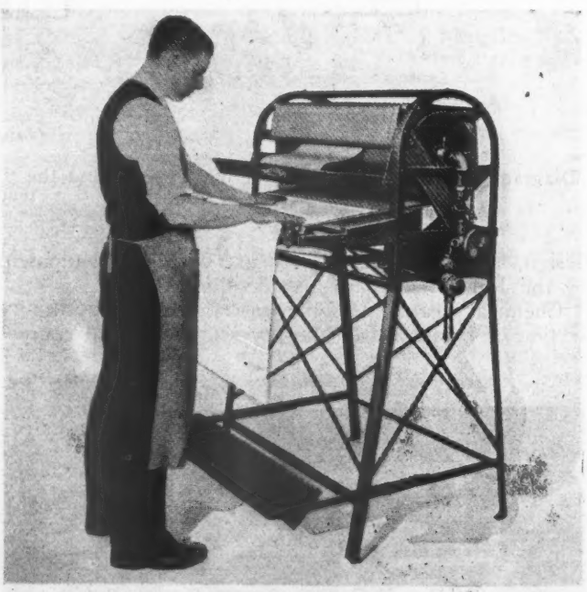
Prints are fed into the dryer over a brass scraper rod and up an inclined feed table which drains the water away from the drying drum and prevents steam pockets and creased prints. Beneath the feed table is located an adjustable drip pan where all surplus water is collected. This pan can be raised or lowered as required for handling either long or short prints. After drying, prints are automatically returned into an adjustable tray at the front of the machine which can be pushed back out of the way when exceptionally long prints are being run.

The revolving copper drying drum can be furnished with either gas or electric heating elements; also, it can be had chromium plated when so specified. Chromium plating is recommended for use in connection with drying photo prints as the drum can be easily cleaned with a damp cloth and will not be affected by chemicals.

When equipped with a gas heater, the revolving copper drying drum contains one burner and can be heated to proper drying temperature in about three minutes. The dryer is equipped with a hand-regulated air-mixer valve and consumes approximately 20 cubic feet of gas per hour.

When equipped with an electric heater, the drying drum contains two Nichrome wire heating units which are capable of heating it to proper drying temperature in about 10 minutes. Each of these units is controlled by a separate switch. When operating on 110 volts, the electric heating units consume about 35 amperes and when operating on 220 volts the heating units consume about 20 amperes. The motor operating the drum consumes 1½ amperes. The heating units are automatically cut off when the motor is shut down.

The dryer is constructed with an angle-iron frame finished in olive-green enamel. It is equipped with a ⅛-hp. motor and variable gear drive for two speeds, either two or three feet per minute. At the front and right-hand side of the machine is a hand-screw regulator for controlling the canvas band. All parts of the machine are accessible and can be easily cleaned and oiled.



The Pease Junior-model sheet dryer

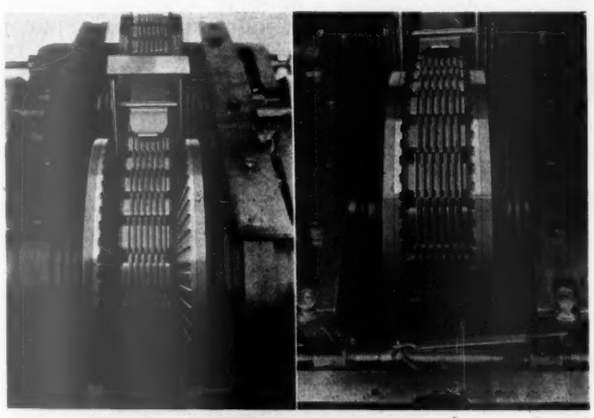
The overall height of the Junior dryer is 5 ft. 3 in. and the floor space it occupies is 3 ft. 5 in. wide by 3 ft. 6 in. deep. The complete machine is shipped fully assembled ready for connection and immediate operation.

Link-Belt Variable Speed Transmission

THE variable speed transmission shown in the illustrations consists basically of two pairs of wheels of the opposed conical-disc type, between which a unique chain transmits power. The effective diameters of each pair of wheels can be altered under load to change the speed ratio, without steps and without dependence on friction. On changing speed, the self-pitching chain rises in one set of wheels and descends in the other, so that while the input shaft connected to a motor or other source of power turns at constant speed, the output shaft is brought to the desired revolutions per minute.

The variable-speed device is designated as the P. I. V. Gear, the initials standing for "Positive Infinitely Variable," indicating its characteristics, and is the product of the Link-Belt Company, Philadelphia, Pa. The wholly original feature of the P. I. V. Gear is its use of a positive chain drive to transmit the power. Radial teeth are cut in the conical faces of the driving discs, and the self-adjustable teeth projecting beyond the sides of the chain are arranged to engage the radial teeth of the discs.

The chain used in the P. I. V. Gear is made up of a series of steel leaves or links with joints consisting of hardened-steel pins turning in segmental bushings. There are no teeth on the inner surface of this chain. Instead, what may be called teeth are made up of packs of hardened steel laminations or slats which extend through slots in the links at right angles to them, and project about ⅛ in. at each side of the chain. The



The tooth formation of the P.I.V. chain on the minimum (left) and the maximum (right) diameter of wheel

individual containers which hold the packs of slats are secured in the openings of the links but, within each such container, the slats are free to slide from side to side individually with relation to each other and adjust themselves to engagement with the radial teeth of the discs over substantially the full range of diameters. The angle of the slat ends is 30 deg., the same as that of the conical faces of the wheels.

The teeth of the discs widen from the center outward toward the circumference, but are of uniform depth. They are staggered relatively on each pair of wheels so that the slats move back and forth into the teeth to mesh correctly as the chain comes into contact with the wheels. Self-pitching of the chain to any tooth width or wheel diameter is thus assured. At each engagement of the chain and wheels, the slats are regrouped within their separate containers, but do not slide nor move under working pull. Their movement in engaging with the wheels is complete before the load is applied.

All the elements of the P. I. V. Gear are built into and protected by an oil-tight housing, and are automatically splash lubricated. The hardened steel wheel faces are mounted on cast-iron hubs backed by ball thrust bearings, and move axially on the shafts, which in turn are mounted in radial ball bearings. The movement of the pairs of wheels together or apart, in order to increase or decrease their effective pitch diameters, is controlled by a pair of pivoted levers operated through a hand control shaft with right-and-left-hand screw motion. Initial chain tension is provided for by an external adjustment screw by two hardened shoes which ride lightly on both upper and lower strands of the chain, under constant spring pressure. A speed indicator permits a ready check-up on operating speed settings.

The unit has been put to production by the Link-Belt Company for the present in five sizes, from 1 to 10 hp. capacity, providing speed change ratios up to a maximum of six to one. It has been tested throughout the past year by continuous operation in driving machine tools, textile equipment, baking, glass- and paper-making machinery.

Dulux—A Synthetic Paint Vehicle

A NEW vehicle for use with interior, and exterior, finishing materials and a group of paints and enamels utilizing it, has been developed by E. I. du Pont de Nemours & Co., Incorporated, Wilmington, Del. Designated as Dulux, the vehicle is used in two forms: Dulux gum serving as a vehicle for enamels and Dulux oil serving as a vehicle for paints. The Dulux vehicles are made by chemical reactions which require extremely close chemical control and which, when completed, have none of the properties commonly associated with the usual resins, gums and oils used in paint manufacture. They are distinct chemical compounds, their properties depending as much upon the method of manufacture and upon control during manufacture as they do upon the ingredients used.

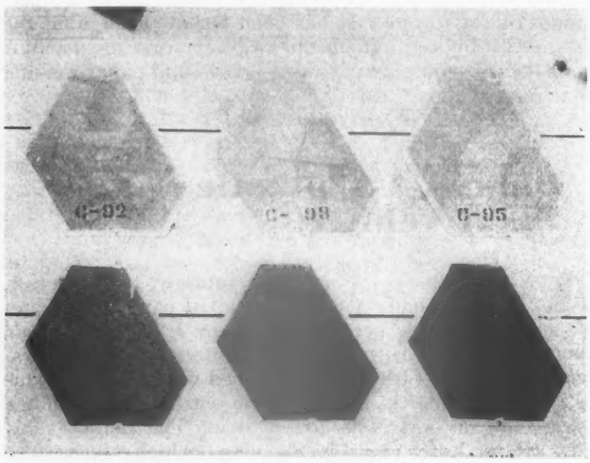
In the Dulux products using these vehicles for interior and exterior enameling, Dulux gum is used to bind the pigment together. This is a rubbery material which hardens to the toughness of horn and is said to have remarkable durability and retention of elasticity. It is dissolved in special solvents to form the Dulux vehicle and in no way is associated with the common practice in making paint vehicles by dissolving resin, fossil gum or brittle synthetic resins in oil by the application of heat. Enamel finishes using this gum as a vehicle are designed for use on machinery, furniture, signs, busses, railway equipment, etc., where a quick-drying, hard, enamel-like finish is desired. In Dulux finishes for exterior and interior painting, an oil-like vehicle is used which gives softer but more durable films than the gum-like vehicle used for enameling. This oil, like Dulux gum, is a synthetic product and has no relationship to the material ordinarily used at present in the paint trade. Finishes from this oil are used in the places where linseed oil or chinawood oil paints are now commonly used, as, for example, on building exteriors, bridge and steel work, etc.

To determine the relative durable qualities of Dulux

oil and linseed oil, comparative tests were made with ordinary vehicles and with the Dulux vehicles by the du Pont Company. Ordinary white-pine clapboard panels were coated, in one case with linseed oil, in another case with heat-bodied linseed oil and in a third case with Dulux oil and placed on exposure racks at an angle of 45 deg., facing south. In six months, according to the records of the du Pont Company, the linseed oils had disintegrated to such an extent that they no longer protected the wood and the panels were badly warped. At the end of two years the panel coated with Dulux oil was still in perfect condition. Numerous other comparative tests were made, all of which are said to have indicated the superior durable qualities of the Dulux vehicles.

Dulux for Interior and Exterior Painting

To test further the Dulux oil vehicle used for interior and exterior painting, equal quantities of a pigment of maximum chalking or fading tendency were placed in a Dulux oil vehicle and in a linseed oil vehicle. The



.0028 in. .0040 in. .0062 in.
.0027 in. .0043 in. .0076 in.

Top row—Different thicknesses of Dulux oil on polished metal. Bottom row—Similar thicknesses of linseed oil on polished metal. All panels exposed 100 days on a 45 deg. fence at Wilmington, Del. to compare the corrosion of the two vehicles

panels painted with these products were exposed side by side on the same exposure fence at 45 deg. The du Pont records reveal that the linseed-oil paint chalked through to the wood in less than eighteen months while the Dulux oil product was still in perfect condition at the end of that period. The same test was made on panels painted with a pigment of maximum cracking tendency. At the end of eighteen months the linseed-oil paint cracked and flaked through to the wood while the Dulux paint was still giving complete protection to the wood. Similar tests were made comparing Dulux products for exterior painting with ordinary white lead, linseed-oil white exterior paints and with various colored paints with linseed oil vehicles. Invariably, it is said, the Dulux paints withstood longer than the others any tendency to fade, chalk or whiten.

Metal Protection

For the protection of metal, the high resistance qualities of Dulux products were also established to the satisfaction of the du Pont Company by comparative tests, similar to the ones mentioned above, with paints of linseed oil base. In addition, tests were completed to determine the permeability of Dulux to moisture.

From this test, the results of which are shown in the chart, Dulux oil, both clear and pigmented, was found to be approximately three times as impermeable as linseed oil and approximately twice as impermeable as ordinary metal-protective vehicles containing blends of linseed oil, chinawood oil and spar varnish.

Under ordinary conditions Dulux finishes for exterior and interior painting are dust free in three to six hours, and dry enough for recoating in from eight to eighteen hours. They atomize freely and are therefore suitable for spray application but still have enough body to adhere to vertical surfaces without sagging, breaking or running.

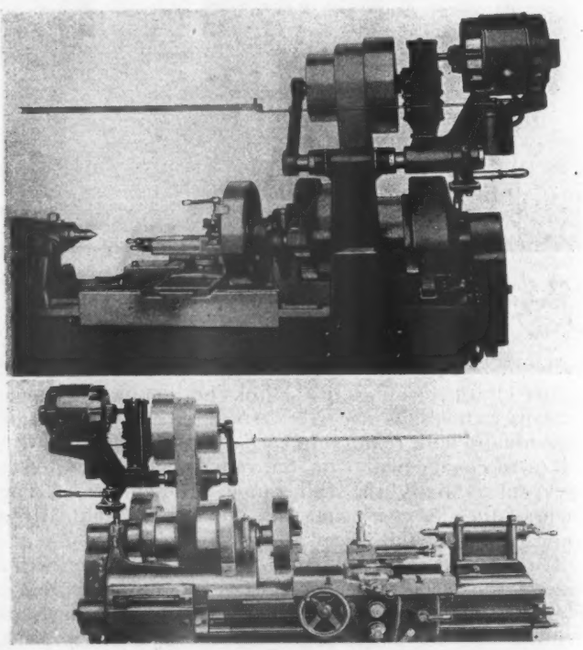
Dulux for Exterior and Interior Enameling

Dulux products for enameling are flexible when first applied and retain their flexibility over a long period of time. They are also resistant to chipping or cracking.

The enamels dry quickly, being dust free in approximately twenty minutes and may be recoated within one hour after the first application. The film is tack free in four to five hours and hard in ten to twelve hours, after which it is said to resist effectively the action of heat, alcohol, gasoline and oil.

The Cullman Lathe Drive

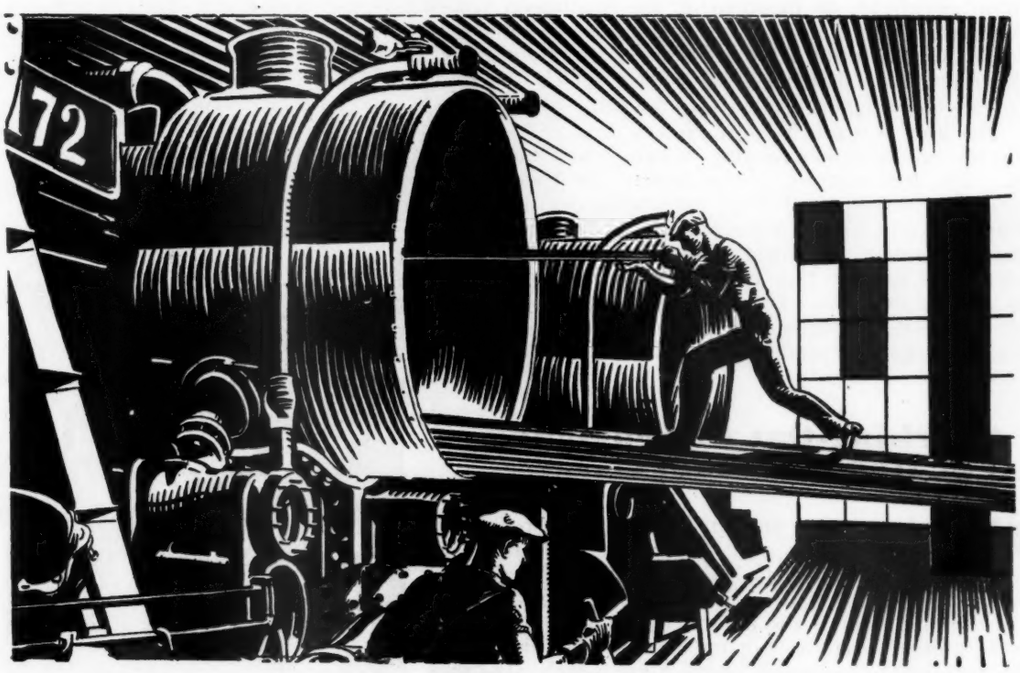
IN the illustration is shown an application of the Cullman lathe drive, an individual electric motor drive for lathes which were originally designed to be operated by means of cone pulleys and a belt. The drive, built by the Cullman Wheel Company, 1344 Altgeld street, Chicago, consists of a bracket mounted on



The application of the Cullman lathe drive for motorizing belt-driven machines

(Continued on next left-hand page)

Over twice the service from TONCAN IRON TUBES



■ Every 12 months, a certain western railroad was forced to re-tube the locomotives on a bad water division.

REG. U.S. PAT. OFF.
TONCAN
COPPER
Mo-lyb-den-um
IRON

■ Then they tried tubes of Toncan Iron. After 26 months' service, the Toncan tubes were removed, found to be in excellent condition, and re-applied to a switcher for further service.

■ By alloying refined iron, copper and molybdenum, a material of greatly improved resistance to corrosion was created. This Toncan Iron makes an ideal boiler tube. Besides resisting corrosion, it is seamless and can be readily welded. Cold-working has no effect on its corrosion resistance.

■ Tube with Toncan Iron and reduce boiler maintenance.

Central Alloy Division

REPUBLIC STEEL CORPORATION

General Offices: Massillon, Ohio

the back side of the lathe, a Cullman speed-reducing unit and drive shaft for mounting a cone pulley, a driving motor and a suitable table for mounting the various parts of the unit.

The upper end of the bracket is machined to receive a foundation shaft and is provided with clamping bolts to permit alining the bearings carrying the shaft. Two collars for side adjustments, the main bracket carrying the Cullman speed reducer with a shaft extension for mounting the cone pulley, the motor and a reversible drum switch are all mounted on the foundation shaft. A device for raising and lowering the cone pulley, to facilitate adjustment of belt tension, is also mounted on the foundation shaft together with a spring for supporting the weight when shifting the belt.

The unit is made in capacities of 1, 2, 3, 4 and 5 hp. for driving lathes ranging in size from 14 in. to 36 in. The belt shifting device lowers the cone pulley 1 in. on the 1-hp. and 2-hp. units while on the 3-hp., 4-hp. and 5-hp. units it lowers the pulley 1¼ in. On the extreme end of the raising and lowering device is an adjustable support that can be set at any convenient location on the lathe. The cone pulley which is mounted on the shaft extension driven by the speed reducer is the one originally used on the old countershaft.

Sparking-Out Attachments For Heald Grinders

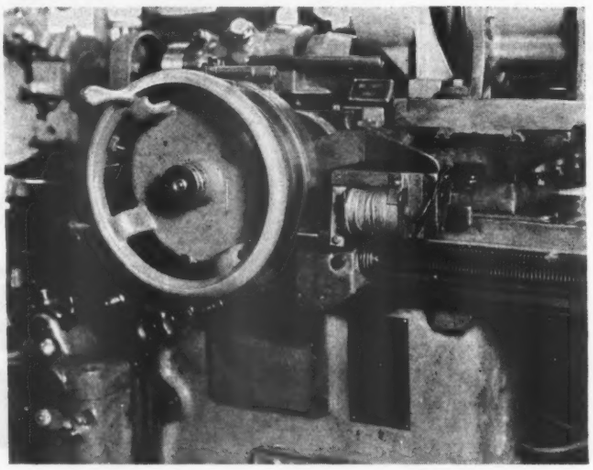
ON high precision internal grinding jobs requiring fine finish it is a well known fact that after the feed of the machine has been discontinued a certain period of time is required for the wheel to spark out. This sparking out is the natural dying out of a transverse pressure that is built up between the wheel and the work by the in-feeding function and which takes the form of a very minute spindle deflection.

Taking advantage of this condition, the Heald Machine Company, Worcester, Mass., has developed sparking-out attachments for the Gage-Matic and Size-Matic internal grinding machines which it manufactures. By automatically interrupting the cross feed and allowing sufficient time for the pressure present in the spindle to dissipate itself naturally as the wheel is reciprocated in the bore of the piece being ground, these attachments aid the machines materially in producting accurate and finely finished holes.

On the Gage-Matic, the hole is rought ground in the usual manner, the roughing gage attempting to enter the hole after each pass of the wheel until the gage does enter and cause the wheel to be withdrawn for dressing. The gage is of such size that after the work has been rough ground and the wheel has been trued, there is just enough stock left so that it will be removed by the pressure in the spindle when it is returned to the bore. The wheel, due to this pressure, then cuts itself free, bringing the hole to size and allowing the finish gage to enter which in turn causes the machine to go to rest position.

When the roughing gage enters, besides causing the wheel to withdraw for dressing, an electrical contact is made which actuates an electro magnet on the cross-slide unit, disengaging the feed pawl and holding it out of engagement with the feed ratchet throughout the finishing cycle. In other words the cross feed is automatically disengaged after roughing and the hole brought to size by the pressure remaining between the wheel and the work. The time required for the sparking out is governed by the amount of stock left in the hole after roughing and the adjustment of the truing diamond. Inasmuch as the roughing gage constitutes a definite and constant limit the amount of stock remaining can be held to a very small amount and hence the sparking out time to a correspondingly short period. An electrical connection between the coil of the magnet and the toggle switch on the control box of the machine serves to keep the magnet operative and the feed pawl disengaged until the finishing passes of the wheel have been completed and the table run out to rest position.

A micrometer diamond unit is used and it is important to note that the position of the diamond governs the finish obtainable. Moving the diamond inward trues more material off the wheel, hence the wheel goes back into the hole with a lighter pressure, and takes a larger number of passes to bring the hole to a finished size. This of course gives improved finish, and reduces



The time relay which permits the Heald Gage-Matic grinders to spark out, bringing the hole to accurate size after the cross feed has been disengaged

production in the same ratio. The converse is equally true, that is, moving the diamond outward increases the production and gives a less perfect finish.

The sparking-out attachment for the Size-Matic consists of a time relay mounted on the machine to regulate the sparking-out time, and a cam attached to the top of the fine feed cam on the handwheel to stop the feed just after the finish contact on the handwheel is made.

The machine operates in the usual manner, except that when the finishing contact is made it engages the time relay instead of tripping the table dog, and the grinding wheel continues to reciprocate in the work without feeding. After a predetermined length of time, the time relay trips the table dog, which runs out the table to rest position.

The principle of operation of the Size-Matic device is that the wheel is always trued so that its working face is a certain distance from the finished size of the part being ground. That is to say, when the wheel reenters the work after dressing, the amount of pressure between the wheel and work is always the same within narrow limits. This allows a uniform amount of stock to be removed in a given length of time after the feed is stopped.

To vary the finish obtainable with this arrangement, it is necessary to adjust both the diamond and the time

(Continued on next left-hand page)

"POWER"

The Locomotive of Tomorrow *Must have Greater Power . . .*

ONLY by using locomotives that provide this higher power economically can the earnings of railroads be raised to new high levels.

"Super-Power Principles" have so intensified power production that the simple, ten-coupled, two-cylinder locomotives recently built by Lima for the Chesapeake and Ohio Railway Company exceed the power of simple Mallets. Intensive power production in a two-cylinder unit thus reduces both operating costs and maintenance.

These latest additions to the ranks of modern power are replacing locomotives of an average age of less than ten years.

It is the railroads with the greatest proportion of such modern power that prosper.

LIMA LOCOMOTIVE WORKS INCORPORATED

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relay. To improve the finish, the diamond must be moved inward, and at the same time in order for this not to affect the size, the interval of the time relay must be increased. In other words, the diamond has precisely the same effect on finish as on the Gage-Matic with sparking-out attachment. On the Size-Matic machine, however, the diamond also governs the finished size of the piece. In order to prevent the size from becoming smaller as the diamond is moved inward, it is necessary that the interval of the time relay be increased to allow a greater length of time for sparking out. This increases the number of finishing passes, and compensates for the alteration in the diamond setting. Opposite adjustments produce the opposite effect.

Unit-Cylinder Clasp Brake for Tender Trucks

THE Unit-Cylinder tender-truck clasp brake, first applied to Canadian National Locomotive No. 5700, as described in the December issue of the *Railway Mechanical Engineer* is being supplied exclusively by American Steel Foundries. It has all the distinguishing characteristics of the present standard tender-truck brake with the addition of the Unit-Cylinder feature. Two small brake cylinders are applied at the inside ends of the truck frames. The cylinders actuate levers fulcrumed to the frame, and these levers, through the medium of pull rods, transfer the power to the main truck clasp brake.

The clasp brake, itself, comprises the usual system of double vertical levers which are connected by a horizontal lever to the brake cylinder mounted on each inside corner of the truck. As shown in the drawing, both clasp brake lever systems are connected to the same brake beams.

Heavy annealed copper pipe with heavy-duty fittings is rigidly attached to the truck frame and brought over to a point as close as possible to the center plate. A flexible metallic pipe is then used to connect this pipe to the main air brake pipe which is attached to the body of the tender. This permits the truck to swivel without a "break-in-two."

The Unit-Cylinder brake has many distinct advantages over the present tender-brake rigging, consisting of the truck brakes and the body brake, a few of the most outstanding of which will be mentioned.

The body brake is entirely eliminated, leaving that portion of the tender frame between the trucks clear for the application of stoker mechanism and other special equipment.

Trucks equipped with the Unit-Cylinder brake can be interchanged as a unit under other tenders with longer or shorter king pin centers, inasmuch as no body brake connecting rods or others affecting body conditions need be considered.

Considerable lost motion in brake rigging is eliminated with the new brake arrangement, insuring a more rapid brake application and shorter and easier stops.

On sharp curves there is a tendency toward twisting the truck levers on the usual truck and body brake application, due to the angular pull from the body brake which is supported from the tender frame. The Unit-Cylinder brake is an independent truck unit and is not affected by curves, regardless of their degree.

With the Unit-Cylinder brake, four 10-in. brake cylinders have sufficient power to brake practically any size of tender with a total ratio of 9 to 1, or under. The cylinders are easily accessible for packing renewal and more easily handled than the heavier and more bulky 16-in. or 18-in. cylinders generally used for body brakes.

A Unit-Cylinder brake has also been designed and built for application to six-wheel passenger-car trucks with an automatic slack adjuster used in conjunction with the cylinder arrangement. Here again the same advantages as on tenders are apparent, especially in the case of the elimination of all foundation brake rigging from the underside of the underframe, permitting the free use of this space for special equipment.

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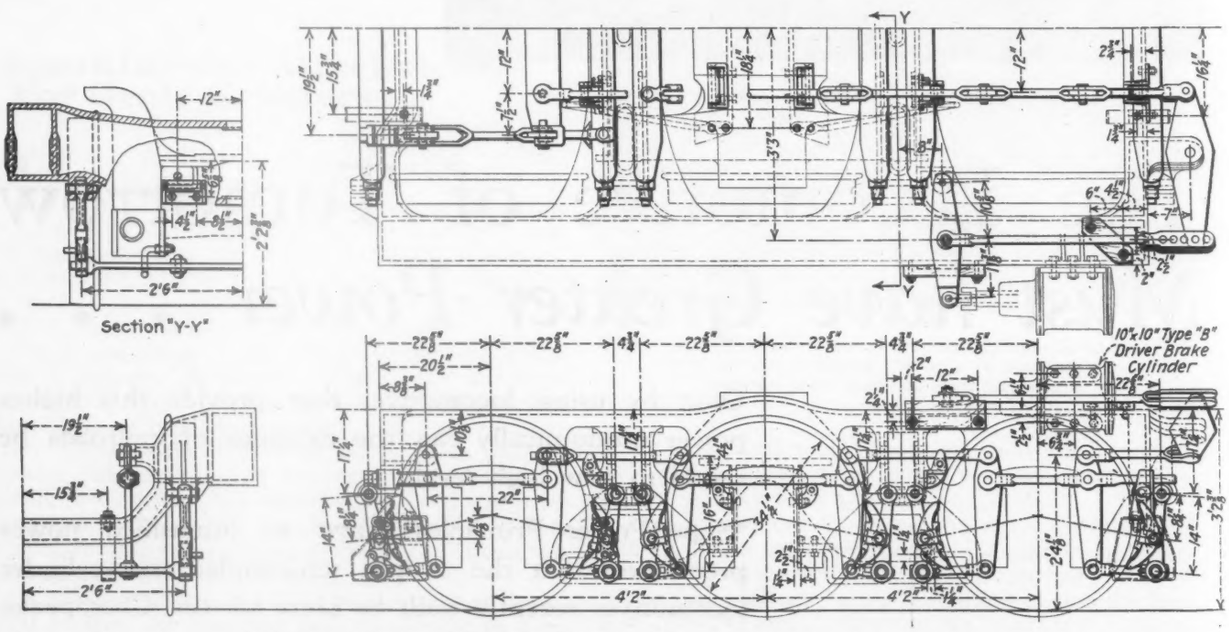

The Unit-Cylinder clasp-brake arrangement for tender truck applications

LIMITED CUT-OFF SWITCHERS SAVE 25% IN FUEL . . .

New Kentucky and Indiana Terminal Locomotives are also Improving Operation by 27%

CONCERNING the new Limited Cut-Off Switchers recently placed in service, Mr. W. S. Campbell, Manager and Chief Engineer of the Kentucky and Indiana Terminal, reports:

■ "Regarding the consumption of fuel, we are showing a saving of about 25 per cent. In other words, the new engines (with larger cylinders, practically twice as heavy and double tractive effort) are consuming very little more coal than the light engines being retired."

■ In the past, standardization and low initial cost have been major considerations in switch engine purchases, rather than maximum efficiency.

■ But now progressive roads are specifying, in new switchers, the elements that have made modern road engines so efficient.

■ Among these is the Limited Cut-Off. With the Limited Cut-Off, switch engines use up to 30% less fuel, 38% less water, have a greater radius of operation, and by reason of the more uniform torque are less likely to slip, resulting in lower maintenance. The lower steam consumption makes possible the use of a smaller grate, thereby lessening standby losses and again saving fuel. They are snappier and do the job quicker.

FRANKLIN RAILWAY SUPPLY COMPANY, Inc.

NEW YORK CHICAGO ST. LOUIS SAN FRANCISCO MONTREAL

Among the Clubs and Associations

CANADIAN RAILWAY CLUB.—At the meeting of the Canadian Railway Club to be held in the York Room of the Windsor Hotel, Montreal, Canada, on February 9 at 8 p.m., the Hon. Duncan Marshall, late Minister of Agriculture, Alberta Government, will speak on Wheat and Its Relation to Canadian Farming.

NEW ENGLAND RAILROAD CLUB.—J. J. Pelley, president of the New York, New Haven & Hartford, will address the members of the New England Railroad Club at 6:30 p.m. on February 18 at the Copley-Plaza Hotel, Boston. It is expected that the presidents of all the New England railroads will be present at this meeting.

CLEVELAND RAILWAY CLUB.—The Cleveland Railway Club will hold its next and succeeding meetings at the Auditorium in the Brotherhood of Railroad Trainmen's building, West Ninth street and Superior avenue, Cleveland, Ohio. The time of meeting has also been changed from the first Monday to the second Monday of each month, the next meeting being on February 9 at 8 p.m. when there will be a continued discussion of the 1931 A.R.A. mechanical rules.

CINCINNATI RAILWAY CLUB.—Armco night will be the feature of the February 10 meeting of the Cincinnati Railway Club which will be held at 6 p.m. at the Roof Garden of the Hotel Gibson, Cincinnati, Ohio. J. P. Butterfield, assistant manager, development department, American Rolling Mill Company, Middletown, Ohio, will present a paper on the continuous mill process, illustrated by motion pictures. Musical entertainment and dinner will also be furnished.

SAINT LOUIS RAILWAY CLUB.—"How the Department of Agriculture of Illinois, through Its Division of Standardization and Markets, Aids the Railroads in Assisting the Farmers To Prepare Their Commodities for Shipment" will be the subject of a paper by Joe W. Cummins, chief inspector of the Division of Standardization and Markets, to be presented before the meeting of the Saint Louis Railway Club which will be held on Friday evening, February 13, at the Statler Hotel, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—At the February 12 meeting of the Central Railway Club of Buffalo, which will be held at 8 p.m. at the Hotel Statler, Buffalo, N. Y., two papers will be presented as follows: The Effect of Machinery on Maintenance of Way Organization and Work, by Robert Faries, assistant chief engineer, Pennsylvania Railroad, Philadelphia, Pa., and The Ideal of a Perfect Performance, by T. H. Carrow, superintendent of safety, Pennsylvania Railroad, Philadelphia, Pa. Entertainment will be furnished by the Red Arrow Quartet.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—The new A.R.A. rules will be discussed at the meeting of the Car Foremen's Association of Chicago which will be held at the Great Northern Hotel, Chicago, at 8 p.m. on February 9. ¶ The meeting held at the Great Northern Hotel on Monday evening, January 12, was devoted entirely to a discussion of the new A. R. A. rules of interchange. Nearly 300 members of the association were present and, as usual, the argument regarding different points of some of the rules was quite heated. The discussion at that meeting proceeded as far as Rule 32.

CAR FOREMAN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—A paper on the Removal and Application of Wheels will be presented by N. A. Johnson, car foreman, Chicago, St. Paul, Minneapolis & Omaha, at the meeting of the Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange to be held at 2 p.m. on February 12 at Omaha, Nebr. ¶At a banquet, which was held on January 24 at the Chieftan Hotel, Council Bluffs, M. P. Schmidt, organizer of the Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange, was the guest of honor. Officers of various roads spoke of their acquaintance with Mr. Schmidt, who is general car foreman of the Chicago, Milwaukee, St. Paul & Pacific, and commended him for his good work in organizing the association which has brought about the expediting of cars through the interchange in a most economical and efficient manner. J. C. Rowe, superintendent of the Armour car shop and chairman of the entertainment committee, acted as toastmaster, and J. E. Mehan, assistant to the superintendent of the car department of the St. Paul, gave a talk on the loyalty and service which Mr. Schmidt has rendered to that road during his 48 years of service. Mr. Schmidt gave his reasons for starting the association and in his talk contrasted the discord existing at that time and the spirit of co-operation which now exists among the various foreman at Council Bluffs. The association was founded 30 years ago.

* * *

A Pennsylvania Decapod

FOURTH NATIONAL FUELS MEETING.—On Friday afternoon, February 13, at the Hotel Stevens, Chicago, a smoke abatement conference will be held in conjunction with the Fourth National Fuels meeting and Midwest Power conference. Experts in the efficient use of fuel for the development of power will assemble from all parts of the country and be available for advice in connection with smoke abatement work. John Hunter, consulting engineer, St. Louis, Mo., will preside at the smoke abatement conference, in the course of which papers will be presented on various important phases of smoke abatement activities, both in this country and abroad. The contribution of the railroads to air pollution by means of smoke will also be discussed, and railroad men will be invited to attend the conference and take an active part in the solution of this pressing modern problem.

Club Papers

Air Conditioning

Western Railway Club.—Meeting held at Hotel Sherman, Monday evening, January 19. Paper on the Effect of Air Conditioning upon Human Beings, by L. L. Lewis, secretary, Carrier Engineering Corporation, Newark, N. J. ¶ In presenting his paper Mr. Lewis discussed fully the effects of air conditioning on the human body and showed a number of lantern slides indicating the relation of many variables which must be considered in the solution of the heating and ventilating problem. ¶ Following Mr. Lewis, F. A. Isaacson, engineer of car construction, Atchison, Topeka & Santa Fe, discussed the application of the Carrier air-conditioning equipment on a Santa Fe dining car, and A. E. Voight, car lighting engineer, described the pro-

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Engineers are hired to maintain

SCHEDULES . .

NOT *to nurse*

BOILER TUBES

Schedules assume that engines and rolling stock in general will perform as intended; and unless that condition is fulfilled, schedules may go by the board.

An engineer is kept busy enough when things are normal. Every hour spent nursing a half-sick or limping engine is a hard hour for him, even if it does not result in actual delays and schedule derangement.

The strength, toughness and durability which are embodied in NATIONAL-SHELBY Seamless Locomotive Boiler Tubes, not only cut down replacements but, what is even more important, they give maximum assurance against annoying and costly interruptions and delays. A description of these tubes and their fitness for all the most exacting requirements of railway service, will be mailed upon request. Ask for a copy of National Bulletin No. 12 describing NATIONAL-SHELBY—

America's Standard Boiler Tubes

US STEEL

NATIONAL TUBE COMPANY

Frick Building, Pittsburgh, Pa.

QUALITY PRODUCTS — Dependable Service

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

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American Bridge Company
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Columbia Steel Company
Cyclone Fence Company
Federal Shipbuilding and Dry Dock Company
Illinois Steel Company
Minnesota Steel Company
National Tube Company
Oil Well Supply Company
The Lorain Steel Company
Tennessee Coal, Iron & R. R. Company
Universal Atlas Cement Company

gram of inspection and maintenance which has been developed for dealing with this car. Mr. Voight said that the car has made 75,752 miles with a maintenance cost of only $305 as of January 8, 1931, and said that studies of the wear of the gear and pinion drive of the generators indicates a probable life of 290,000 miles, although he believes that belt drive can be used satisfactorily. Mr. Isaacson says that in winter a Vapor heating system unit is placed adjacent to the temporarily inactive Aerofin cooling coils and warm air is circulated through the same system which supplies cool air in summer. It is seldom necessary to use the customary side-wall heating coils.

Oil Engines for Railway Service

Canadian Railway Club.—Meeting held in the Windsor Hall of the Windsor Hotel, Montreal, November 17, 1930. Paper presented by C. E. Brooks, chief of motive power, Canadian National, entitled "Development of the Oil Engine for Railway Service." ¶ Mr. Brooks divided his paper into two parts as follows: The general application of the oil engine to railway use, and the development of what may be considered a suitable engine for these purposes. He reviewed the developments during the past seven years in oil-engine design, maintenance costs, reliability, serviceability, and lubrication. Theoretically, he said, the greatest fuel saving possible in a service of any kind is by the elimination of stand-by losses, and as switching service represents a form of operation where fluctuations of load and idle time are at a maximum, it would appear to offer the best field for the internal-combustion engine. As a basis of study of this problem, the Canadian National studied a number of representative switching shifts which were carefully analyzed by means of continuous indication of all power strokes of the engine. ¶ Taking into consideration, Mr. Brooks said, all conditions which we are able to develop, the 450-h. p. oil-electric switcher represents a saving per 24 hours or three shifts, of at least $40. This will amply meet all costs over and above the cost of a standard steam-locomotive switcher capable of performing the same operations. ¶ In conclusion, Mr. Brooks stated that it appears reasonable to expect, in view of the development of internal-combustion engines for other purposes, that the design of the oil engine also will make such progress year by year as will better suit it for the railroad field. One thing is certain, he pointed out, and that is if the oil engine is to be used extensively in railway service, it must be simplified and all parts which require frequent examination must be made more accessible than has been done in the past.

Heating Passenger Trains

Manhattan Air Brake Club.—Meeting held in Room 2300, 150 Broadway, New York, January 16. Talk by R. P. Cooley, district manager, Vapor Car Heating Company, Inc., on "Passenger Train Steam Heating." ¶ Mr. Cooley gave an informal talk to the members of the Manhattan Air Brake Club on questions pertaining to the heating of passenger cars. He included in his remarks descriptions of a number of mechanical improvements made to secure improved heating of long passenger trains. In the course of his remarks he described some of the important developments and improvements in the steam heating equipment for gas-electric rail cars

The Transportation Situation

Southern & Southwestern Railway Club.—Meeting held January 15, 1931, at the Ansley Hotel, Atlanta, Georgia. Address by A. E. Clift, president, Central of Georgia, on "Things the Public Should Know About the Transportation Situation." ¶ In introducing his remarks, Mr. Clift stated that the members of the Southern & Southwestern Railway Club have a direct personal interest in the railroad industry, its present problems and its future prospects. That statement, he said, would have been accurate if made at any time during the past and it holds good today, but it does not go far enough. The truth is, he said, that the transportation situation in the United States at the beginning of 1931 ought to be a matter of direct and vital concern to everyone in the country, because it is no longer a question of operation, or of efficiency, or of any other managerial function. It has taken on the broader economic aspect of a national problem. ¶ The railroads as an industry, Mr. Clift pointed out, are passing through a critical period, and many public men and business man are doing practically nothing to assist them, but on the contrary are further hampering them by favoring policies and practices that tend to curtail further the traffic and the earnings of the railroads. Mr. Clift reviewed the economic situation of the railroads during recent years and pointed out the inequalities of opportunity between the railroads and their competitors. He said that the railroads are asking no favors, no preferential treatment, but only a square deal and fair treatment.

Further Possibilities for Locomotive Utilization

St. Louis Railway Club.—Meeting at St. Louis, January 10, 1931. Paper entitled "Further Possibilities of Efficiency in Railroad Transportation," by D. L. Forsythe, general road foreman of engines, St. Louis-San Francisco. ¶ From the wealth of his experience covering many years in railroad service, Mr. Forsythe gave the members of the club a new appreciation of the development of steam locomotives, from the simple machines first used to the complicated and power-

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* * *

The "Shakespeare"—One of a number of Pennsylvania express cars named after famous actors and actresses for the transportation of scenery used in theatrical productions

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EXTRA SERVICE

The ever-increasing weight and speed of modern transportation throw a tremendous burden on equipment, particularly on wheels. To meet this condition, we are now prepared to furnish special heat treated wrought steel wheels for passenger, engine truck and locomotive tender service; also heat treated wheels for electric railway service, and single and double flanged crane wheels. The process of heat treatment, varying for different types of service, produces a wheel with an especially tough rim and with high physical properties—a wheel that is highly resistant to wear.

"R T" stamped on your wheels means Rim-Toughened. It indicates the additional refinement of heat treatment. It is the mark of extra service—of extra stamina to endure the heavy loads of present-day transportation.

Our wheel engineers are at your service.

CARNEGIE WROUGHT STEEL WHEELS

Product of Carnegie Steel Company, Pittsburgh, Pa. U.S. STEEL *Subsidiary of United States Steel Corporation*

115

ful units now forming such an important part of the railroad transportation machine. He stressed the necessity of increased utilization of locomotives and said that, with proper attention to details, locomotives can now be made to produce as many ton-miles in a month as they formerly did in three months. ¶ Mr. Forsythe described in outline long locomotive runs now being made by a number of roads, as well as tests conducted on the St. Louis-San Francisco and previously reported in these columns. He predicted runs in the no-distant future of 2,000 to 3,000 miles, without changing power, and locomotive tanks built to hold 30,000 gal. of water, 30 tons of coal or 8,000 gal. of fuel oil. He closed his paper with an earnest appeal for more attention to the human element in efficient locomotive operation, without which all mechanical features will be more or less non-effective.

Air Conditioning on Passenger Equipment

New York Railroad Club.—Meeting held at the Engineering Societies Building, 29 West thirty-ninth street, New York, January 16, 1931. Paper by R. W. Waterfill, Carrier Engineering Company, Newark, N. J. ¶ This was a joint meeting of the New York Railroad Club and the Metropolitan Section of the American Society of Mechanical Engineers. Mr. Waterfill's paper, which was sponsored by the Railroad Division, A. S. M. E., was entitled "Air Conditioning on Passenger Equipment." In introducing his paper, the author stated that true air conditioning is the production and maintenance of all the qualities of air, as near as practicable to the ideal for the service performed. The qualities at present most frequently controlled by air conditioning are temperature, humidity, purity, cleanliness, odors, motion and quietness. In some special applications which are at present mainly experimental, he said, qualities which change but little in nature are altered and controlled. These include pressures, oxygen content, the introduction or substitution of other gases and artificial light. Air conditioning, he pointed out, may involve control of any or all of these qualities when benefiting the application practically. ¶ Mr. Waterfill said it is erroneous to assume that air is healthy just because it has been conditioned. Like everything else air conditioning can be overdone, or poorly done. A great deal of harm is frequently done by so altering the properties of air that it is less desirable than originally. Mr. Waterfill's paper included tabular data showing the desirable indoor temperatures in summer, corresponding to outdoor temperatures. The paper covered briefly a number of improvements in the mechanical design of air conditioning equipment. The most important of which was the building of a centrifugal type machine in which it is possible to use existing refrigerants that present no hazards, such as those which make ammonia objectionable.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION I. — SAFETY SECTION. — J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York. Spring meeting April 20-23, Birmingham, Ala.

MACHINE SHOP PRACTICE DIVISION. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

ASSOCIATION OF RAILWAY SUPPLY MEN.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

BOILER MAKER'S SUPPLY MEN'S ASSOCIATION.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Assoc.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 3001 West Thirty-ninth Place, Chicago, Ill. Regular meeting, second Monday in each month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

CAR FOREMAN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—T. J. O'Donnell, 1004 Prudential building, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting second Monday each month, except July, August and September, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS INTERCHANGE CAR INSPECTION ASSOCIATION.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested car department.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S SUPPLY MEN'S ASSOCIATION.—J. H. Jones, Crucible Steel Company, of America, 650 Washington boulevard, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

INTERNATIONAL RAILWAY SUPPLY MEN'S ASSOCIATION.—W. J. Dickinson, acting secretary, 1703 Fisher building, Chicago. Meets with International Railway Fuel Association.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

MASTER BOILERMAKER'S ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION: W. A. Booth, Canadian National, Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

PUEBLO CAR MEN'S ASSOCIATION.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

RAILWAY BUSINESS ASSOCIATION. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular Meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY EQUIPMENT MANUFACTURERS' ASSOCIATION.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division, American Railway Association.

SUPPLY MEN'S ASSOCIATION.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Car Department Officers Association.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

WESTERN RAILWAY CLUB.—W. J. Dickinson, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

(Continued on next left-hand page)

High Capacity Locomotives For Fast Freight Service

4-8-4 TYPE LOCOMOTIVE
WABASH RAILWAY

Cylinders	27" x 32"
Drivers, diameter	70"
Steam pressure	250 lb.
Grate area	96.2 sq. ft.
Water heating surface	5189 sq. ft.
Superheating surface	2360 sq. ft.
Weight on drivers	274,100 lb.
Weight, total engine	454,090 lb.
Tractive force	70,750 lb.

TWENTY-FIVE locomotives of the 4-8-4 type, recently built at these Works for the Wabash Railway, are fine representatives of a class of power that is successfully meeting the present-day demands of heavy, fast freight traffic.

With a starting tractive force of 70,750 pounds, driving wheels 70 inches in diameter, and ample boiler power, these locomotives can start heavy trains; have horsepower capacity to accelerate them rapidly and maintain speed on long runs.

These same qualities make this design suitable for heavy passenger service should it be found necessary to use the locomotives in such work.

THE BALDWIN LOCOMOTIVE WORKS 1831 1931

Present-day service conditions demand present-day motive power. While this may mean the discarding of locomotives still in good condition, the result will be economy.

THE BALDWIN LOCOMOTIVE WORKS
PHILADELPHIA

NEWS

Second Arc-Welding Contest Rules

DETAILS concerning the second Lincoln arc-welding prize competition, which will close on October 1 of this year, are now being distributed by the Lincoln Electric Company, Cleveland, Ohio. The competition, the purpose of which is to increase the knowledge of the adaptability of arc welding to industry as announced in the November, 1930, issue of the *Railway Mechanical Engineer,* is open to any person, or group of two or more persons, in any country of the world. The subject matter of the papers submitted must come under one of the following headings: (a) A description of a useful machine, structure, or building, previously made in some other way, that has been redesigned in whole or in part, so that arc welding is applied to its manufacture; (b) A description of a machine, structure, or building, not previously made that has been designed in whole or in part to the use of arc welding and a description showing how a useful result is obtained which was impractical by means of other methods of manufacture.

The first six prizes will range from $7,500 down to $250, and for the seventh to fortieth prize papers $100 each will be awarded.

B. & O. To Equip Train for Air Conditioning

THE YORK ICE MACHINERY CORPORATION of York, Pa., has received an order from the Baltimore & Ohio to equip with air conditioning machinery all coaches used on the Columbian, operating between Washington, D. C., and New York. The order covers diners, club, observation and chair cars.

The equipment to be installed has been designed jointly by Baltimore & Ohio engineers and the engineering department of the York Company after extensive experimenting and will supersede the style of ventilation now in use. It will permit of ventilation of the coaches at controlled temperatures without admission of smoke or dust.

Each coach will be equipped with a complete air conditioning unit electrically powered, thus providing constant operation whether the car is in motion or standing. The equipment is designed to give a complete change of fresh air in each coach every two minutes at any desired temperature and will make unnecessary opening of windows in summer months or any other period of the year. Air admitted when doors are opened is immediately taken up by the system and passed through the conditioning process.

Hudson County Smoke Ordinance

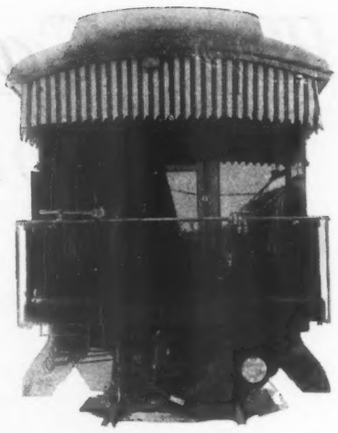
THE BOARD OF HEALTH & Vital Statistics of Hudson County, New Jersey, has adopted a smoke ordinance prohibiting the making of dense smoke within the limits of the county, and establishing a department on smoke regulation. The rules define smoke as No. 3, No. 2, etc., according to the Ringelmann chart. Absolute prohibition is modified by certain exceptions; for example, there is an exception of a locomotive or a steamboat emitting dense smoke not more than two minutes in any period of 15 minutes. Other regulations measure the duration of offenses by half minutes. The construction or alteration of any furnace or stack, etc., can be carried out only on a permit from the smoke department. Violations of the ordinance will incur a penalty of fine or imprisonment or both.

An advisory board of three engineers has been appointed, consisting of Dr. Harvey N. Davis, Roy V. Wright, editor of the *Railway Mechanical Engineer,* and Professor E. H. Whitlock of Stevens Institute of Technology.

C. A. Gill to Undertake Reorganization of Russian Railroads

CHARLES A. GILL, superintendent of motive power, Eastern lines of the Baltimore & Ohio, has been selected by a commission representing the Russian Government to take charge of the modernization of all steam transportation systems in the Union of Socialist Soviet Republics. Mr. Gill, who has been given a leave of absence by the B. & O., has sailed for Russia, taking with him a staff of American railway experts representing practically all branches of the industry. His appointment, which was made following an inspection of railroad methods in nearly every country in the world by groups of Russian railway officials, similar to the party which visited the United States and Canada last summer, gives him jurisdiction over approximately 22,000 miles of main line extending from Moscow to Vladivostok.

Mr. Gill gained his first railroad experience as a machinist with the Baltimore & Ohio. After working on a number of other railroads he returned to the B. & O. as enginehouse foreman, and was promoted to his present position of superintendent of motive power, in 1917.



Co-incident with Mr. Gill's appointment, the Soviet authorities have also decided upon the "mobilization," in the full military sense of the word, of all persons competent to undertake railroad service, according to a dispatch from Moscow to the New York Times. The order, which is based upon a necessity of completely re-organizing the Soviet railway system, requires that all state departments, except those engaged in transportation or national defense, must submit within ten days a list of all their employees who formerly had any experience in or in connection with railway work. Such employees are to be immediately dispatched and are required to report within five days to government labor exchanges where they will be assigned new railroad jobs. Criminal proceedings will be taken against employees who try to evade the present order by concealing previous experience and against employers who permit such concealment or submit a false list.

Rock Island Consolidates Divisions

THE CHICAGO, ROCK ISLAND & PACIFIC, on January 1, consolidated its Dakota division with the Iowa and Cedar Rapids-Minnesota divisions. The portion of the Dakota division between Short Line Junction (Des Moines), Iowa, and Minneapolis, Minn., has been absorbed by the present Iowa division and the name of the latter has been changed to the Iowa-Minnesota division. The headquarters of the Iowa-Minnesota division will remain at Des Moines. The remainder of the Dakota division, which had its headquarters at Estherville, Iowa, has been absorbed by the present Cedar Rapids-Minnesota division, and the name of that division has been changed to Cedar Rapids-Dakota division. The headquarters of the Cedar Rapids-Dakota division will remain at Cedar Rapids, Iowa.

On the same date the jurisdiction of the operating officers of the Rock Island, including general, district and Illinois division officers was extended over the Peoria Terminal. The Peoria Terminal has begun the operation under lease of the Peoria, Hanna City & Western, extending from Hollis Junction, Ill., to Mine No. 6, about 5 miles.

Supply Trade Notes

ROBERT LEE WILSON, assistant to the president of the Westinghouse Electric & Manufacturing Company, has resigned.

THE AMERICAN CHAIN COMPANY, INC., has moved its Boston, Mass., office from 132 High street to the Statler building.

THE INLAND STEEL COMPANY plans to construct a sheet, plate and strip mill at its Indiana Harbor, Ind., plant during the spring.

L. F. RAINS, vice-president of the Columbia Steel Corporation, has been elected president of the A. M. Byers Company, Pittsburgh, Pa.

HARRY S. RANSOM, special representative of the sales and engineering department of the Fort Pitt Steel Casting Company, McKeesport, Pa., has been appointed manager of sales.

WILLIAM K. KREPPS, manager of the eastern railroad department of the Crucible Steel Company of America, at New York, has been appointed general manager of the railroad department of that company, with headquarters at New York.

THE WASHINGTON, D. C., office of the American Steel Foundries has been discontinued and the headquarters of C. B. Peirce, Jr., had been transferred from that city to the office of the American Steel Foundries at 30 Church street, New York.

J. C. KEENE, special representative of the Bradford Corporation, has been appointed also manager of railway sales, Midwest district, Durametallic Corporation, with offices in the Pure Oil building, 35 E. Wacker drive, Chicago.

THE PANGBORN CORPORATION, Hagerstown, Md., has opened district sales offices in Cincinnati, Ohio, and Milwaukee, Wis. Thomas J. Dougherty has been appointed special sales engineer at the home office to cover the Hagerstown district.

THE ALUMINIUM COMPANY OF AMERICA, Pittsburgh, Pa., at a recent meeting of the board elected E. S. Fickes, G. R. Gibbons, and R. E. Withers senior vice-presidents; Harwood Byrnes, S. K. Colby, W. C. Neilson, G. J. Stanley, P. J. Urquhart, and I. W. Wilson, were elected vice-presidents.

RALPH W. BURK, manager of the Detroit branch office of the Kearney & Trecker Corporation, Milwaukee, Wis., has been promoted to the position of sales manager, Eastern division, to supervise and assist the company's representatives in several eastern territories. Mr. Burk's headquarters will be at Philadelphia.

THE AMERICAN MANGANESE STEEL COMPANY, Chicago Heights, Ill., has appointed the Southern Tractor Supply Company, 406 Geer building, Durham, N. C., its representative for the District of Columbia, North Carolina, South Carolina, Eastern Tennessee, Virginia and West Virginia.

H. E. PASSMORE has been appointed assistant to the president of the Verona Tool Works with headquarters at Oakmont, Pa. The R. H. Hyland Company, 225 West Huron street, Chicago, has been appointed representative of the Verona Tool Works for the Chicago territory to succeed Porter Laughlin, resigned.

THE MOHAIR INSTITUTE has been organized and will open headquarters at 7 South Dearborn street, Chicago. The Institute has been formed to further the interests of the American mohair industry. Mohair used in railroad car upholstery will be given special attention. A. C. Gage, editor of the Angora Journal, will be the director of the Institute.

THE JAMES H. KNAPP COMPANY, Los Angeles, Cal., with a branch at San Francisco, has been appointed exclusive Pacific Coast distributor of the products of the Illinois Testing Laboratories, Inc., Chicago, consisting of portable and stationary indicating pyrometers, resistance thermometers and other electrical and magnetic measuring instruments.

THE SOUTHWARK FOUNDRY & MACHINE COMPANY, has transferred the major portion of its asses to the Baldwin-Southwark Corporation, at Eddystone, Pa. The latter corporation has assumed all outstanding liabilities and is carrying on the entire business formerly done in the name of the Southwark Foundry & Machine Company.

THE LINDE AIR PRODUCTS COMPANY, New York, is now handling the products of the Union Carbide & Carbon Corporation units which are used mainly for oxy-acetylene welding and cutting. These products include Linde oxygen, Union carbide, Prest-O-Lite dissolved acetylene, and Oxweld, Prest-O-Weld and Purox apparatus and supplies.

THE MANUFACTURING OPERATIONS of the Fuller Lehigh Company are to be transferred from Fullerton, Pa., to the Barberton, Ohio, works of the Babcock & Wilcox Company. The management, engineering and sales departments will move to New York City. E. G. Bailey, president of the Fuller Lehigh Company, has been elected a vice-president of the Babcock & Wilcox Company.

R. R. WEDDELL, chief engineer of the O. K. Tool Company, Shelton, Conn., has been appointed sales manager, and E. Reaney succeeds Mr. Weddell as chief engineer. A. Curry has been appointed production manager, succeeding Ole Severson who is now in charge of all development and research work. H. Giller, formerly chief tool supervisor of the Chrysler Motor Car Company, is now representing the O. K. Tool Company in the Detroit territory, with headquarters at 5235 Buckingham avenue, Detroit. Mr. Giller succeeds J. Costello who has been appointed assistant sales manager, contacting the machine tool trade.

H. HENGEVELD, who retired on January 1 as master painter of the Atlantic Coast Line, has become a member of the sales force of The Lowe Brothers Company, Dayton, Ohio. Mr. Hengeveld, whose age is seventy years, was forty-two years in the service of the Atlantic Coast Line. For a number of years he has been a member of the Committee of Direction of the Equipment Painting Section of the American Railway Association.

THE GLOBE STEEL TUBES COMPANY, Milwaukee, Wis., has organized a subsidiary, the Globe Stainless Tube Company, to carry on a business of engineering, designing and manufacturing stainless steel tubes and tubular installations for corrosion and heat-resisting purposes. The principal officers of the new company will be the same as of the Globe Steel Tubes Company and sales will be handled through the same offices in principal cities.

CLIFFORD L. SHEEN, sales representative of the American Locomotive Company and Railway Steel-Spring Company at the San Francisco, Cal., district sales office has been appointed general sales representative on the Pacific Coast for both companies, with the title of district sales manager and headquarters at the present office in the Rialto building, San Francisco. Otis R. Hale, former district sales manger at San Francisco, has retired. Mr. Sheen, after completing an apprenticeship of four years in the shops of the Chicago & North Western at Clinton, Iowa, entered the service of the American Locomotive Company in 1920 and until 1925 served as an inspector in the various departments of the company's Cooke plant at Paterson, N. J., and later was appointed a traveling engineer for the company for service in South America. He subsequently served in the same capacity in the United States and in 1927 when he was transferred to the San Francisco district office he was appointed a sales and service representative.

A. E. BALLIN, president and a director of the McIntosh & Seymour Corporation, Auburn, N. Y., a division of the American Locomotive Company, has retired, and R. B. McColl, manager of the Schenectady plant of the American Locomotive Company, succeeds Mr. Ballin as president and a director of the McIntosh & Seymour Corporation. R. P. Allison, manager of the Dunkirk, N. Y., plant of the American Locomotive Company, succeeds Mr. McColl as manager at Schenectady, and John S. Stevenson, in charge of general development work of the American Car & Foundry Company at New York, succeeds Mr. Allison as manager of the Dunkirk plant.

T. K. QUINN, Cleveland, Ohio, and Charles E. Wilson, Bridgeport, Conn., have been elected vice-presidents of the General Electric Company; H. H. Barnes, Jr., New York, has been appointed a commercial vice-president in charge of the New York district, and J. L. Buchanan, Bridgeport, Conn., has been appointed president of the General Electric Supply Corporation. Charles E. Patterson, vice-

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ALCO FORGINGS

WE have shown with what care the steel of ALCO forgings is selected; the pains taken in its preparation, and how thoroughly inspection is conducted to guard against imperfections occurring in material before forging is begun. Let us now take up the important subjects of heating and forging.

AMERICAN LOCO

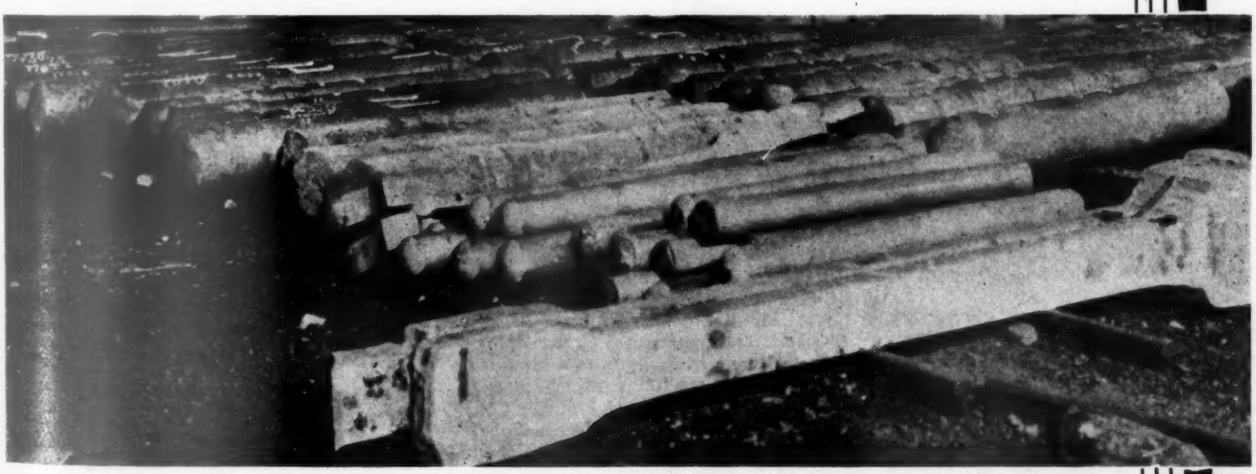
30 CHURCH STREET

Heating before forging is of vital importance. Charging steel into a hot furnace often causes internal ruptures. This is especially true for the alloys and the higher carbon steels and even for medium steels in cold weather.

To avoid damage to the billets and to insure complete control over the heating of the steel before forging, six regenerative furnaces have been installed. In normal operation there are two cool furnaces ready for charging, two hot furnaces containing steel ready for the press and hammer, and the remaining two cooling off. These furnaces are oil-fired, the flame at no time coming in direct contact with the charge in the furnace—and all the furnaces are equipped with indicating and recording pyrometers. This equipment gives us a complete history of the forging during heating and enables us to know the rate at which the heat is applied, the time of soaking at heat to insure proper penetration, and that the proper temperature has been reached before withdrawing for forging. From this point the steel is taken quickly to the press or hammer—the press and hammer used being of sufficient capacity to insure proper penetration well into the mass.

A locomotive is no more dependable than the forgings used in its construction. The kind of forgings used largely determines the kind of service obtained.

ALCO forgings will multiply the utility and economy of your motive power both old and new.



OMOTIVE COMPANY
NEW YORK CITY

president in charge of the merchandise department of the General Electric Company, and Cummings C. Chesney, one of the two vice-presidents in charge of manufacturing, have retired.

THE MILWAUKEE ELECTRIC CRANE & HOIST CORPORATION, which has been operated as a subsidiary of the Harnischfeger Corporation since 1928, has been consolidated with the parent company and is being operated as the Milwaukee division. D. E. Patterson, general manager of the Milwaukee Crane and vice-president of the Harnischfeger Sales Corporation, is in charge of the crane and hoist sales. Carl Haugaard has been appointed assistant treasurer of the Harnischfeger Corporation, and Walter Harnischfeger, vice-president, has been elected president and treasurer to succeed Henry Harnischfeger, deceased.

R. R. WASON has been elected president of Manning, Maxwell & Moore, Inc., New York, to succeed C. A. Moore, who was president of the company since April, 1927. Mr. Moore retains his contact with the company as chairman of the board of directors. Mr. Wason was also elected president of the Consolidated Ashcroft Hancock Company, Inc., one of the subsidiaries of Manning, Maxwell & Moore, Inc. Mr. Wason's entire career has been connected with merchandising and management problems. He was for many years director of merchandising of the Proctor & Collier Company, Cincinnati, Ohio. Early in 1922 he came East to represent banking interests in the Clark Lighter Company.

JAMES K. AIMER has been appointed assistant general manager of sales in charge of railroad, locomotive and car equipment sales, also bar iron and billets sales for the Reading Iron Company, Reading, Pa. Mr. Aimer's headquarters are at 230 Park avenue, New York. In addition to the supervision and direction of all sales to railroads, Mr. Aimer will direct the sales of Reading charcoal iron boiler tubes, formerly under the direction of George H. Woodroffe, metallurgical engineer. Mr. Woodroffe will now handle all complaints and serve in an advisory capacity to the general sales organization with respect to technical problems. F. W. Deppe, district sales representative at St. Louis, Mo., has been appointed general manager of sales with offices at New York.

JOSEPH T. RYERSON & SON, INC., Chicago, has acquired the lines of Maximillers, production millers and automatic indexing machines heretofore produced by the Kempsmith Manufacturing Company of Milwaukee, Wis. The transfer involves an outright purchase of good will, patents, patterns, and other assets pertaining to these lines. The cone drive milling machines produced by the Kempsmith Company are not involved in the transaction. The Ryerson Company will act as general distributors of the Kempsmith line, direct the sales policy and furnish through a special engineering staff, including Walter Mickelson, formerly associated with Kempsmith, the necessary services to the trade and support to its local sales agencies in the active promotion of these machine tools. The Sidney Machine Tool Company of Sidney, Ohio, manufacturers of engine lathes, will take over for the Ryerson Company full manufacturing responsibilities in the building of the former Kempsmith products, and will discontinue the building of its older type of engine lathes, confining its efforts to the production of the milling machine line and the Monotrol and Tritrol types of lathes. H. L. Livesay, former factory manager of the Kempsmith Company, has been placed in full charge of the production of milling machines at the Sidney plant.

Obituary

GEORGE SHIELDS, eastern sales manager for The Dayton Manufacturing Company, with office at 25 Church street, New York, died on December 25.

WILLIAM S. BARTHOLOMEW, retired president of the Locomotive Stoker Company and a retired vice-president of the Westinghouse Air Brake Company, died on January 6, at his home, Pittsburgh, Pa., following a short illness from a heart attack. Mr. Bartholomew was born on November 17, 1864, at Warren, Ohio, and received his early education at Detroit, and at Chicago, where he also later matriculated in Northwestern University. His first business training was received in

William S. Bartholomew

the ship chandlery business, from which he went to the Adams & Westlake Company, eventually becoming the company's eastern manager in Philadelphia. In 1903 he became associated with the Westinghouse Air Brake Company as its New England representative at Boston, Mass., being transferred in 1905 to Chicago as its western manager. In 1913 he became president of the Locomotive Stoker Company, a subsidiary of the Westinghouse Air Brake, at Schenectady, N. Y., and since 1916, when the plant of that company was moved to Pittsburgh, Mr. Bartholomew has lived there. As executive head of the Locomotive Stoker Company Mr. Bartholomew developed the mechanical stokers used in locomotives throughout the United States and in foreign countries. In addition to these duties, in 1918 he became vice-president of the Westinghouse Air Brake Company in charge of sales. He retired in 1928.

Personal Mention

General

GEORGE WHITELEY, assistant superintendent of motive power, eastern lines, of the Canadian Pacific, has been appointed superintendent of motive power.

ALEXANDER PEERS, master mechanic of the British Columbia district of the Canadian Pacific, has been promoted to assistant superintendent of motive power at Montreal.

G. S. WEST, master mechanic of the Philadelphia Terminal division of the Pennsylvania, with headquarters at West Philadelphia, Pa., has been appointed acting superintendent of motive power of the Southwestern division, with headquarters at Indianapolis, Ind.

P. M. HAMMETT, superintendent of motive power of the Maine Central, has retired. Mr. Hammett had been in railroad service for forty years. He was appointed master mechanic of the old Boston shop of the Boston & Maine in July, 1896. When the Boston & Maine acquired the Fitchburg Railroad in 1900, he was appointed assistant superintendent of motive power. He continued in that position until his appointment as superintendent of motive power of the Maine Central.

FRANCIS G. LISTER, who has been promoted to assistant general superintendent of motive power of the St. Louis San Francisco, with headquarters at Springfield, Mo., has been engaged in railway work for nearly 30 years. He was born at Marysville, Kan., on July 8, 1882, and attended the University of Nebraska for two years. He entered railroad service in 1901 as a special apprentice on the Wabash, and in the following year was advanced to the position of mechanical draftsman. In 1906 he became a locomotive and car draftsman in the employ of the Northern Pacific; in 1911, appointed chief draftsman, and later mechanical engineer of the Spokane, Portland & Seattle and a number of subsidiaries which are now a part of that railroad. In 1916 he became mechanical engineer of the El Paso & Southwestern. When the latter road became a part of the Southern Pacific in 1924 he was appointed master car repairer at El Paso, Tex. Mr. Lister was appointed chief mechanical engineer of the Frisco, with headquarters at Springfield, in 1926, his promotion to assistant general superintendent of motive power becoming effective on January 1.

F. W. HANKINS, chief of motive power of the Pennsylvania at Philadelphia, Pa., has been promoted to the position of assistant vice-president, operation, and will also continue as chief of motive power. Mr. Hankins was born in London, England, in 1876, and came to this country in 1880. He received his education in the public schools at Foxburg, Pa., and began his railroad career with the Pittsburgh &

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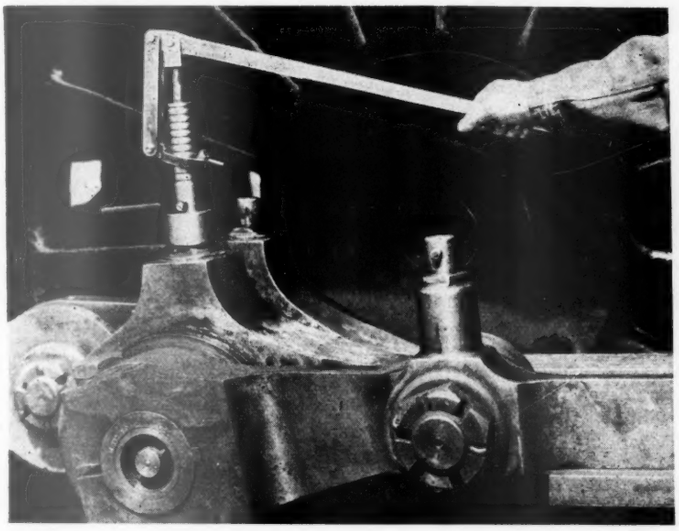
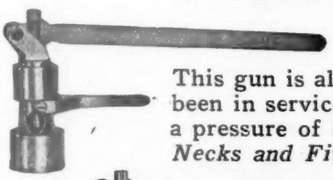


The "SPEE-D" WAY

THE "SPEE-D" High Pressure Method of rod cup lubrication is now standard on many of the large leading railroads. The savings effected have paid these railroads a big return on the investment.

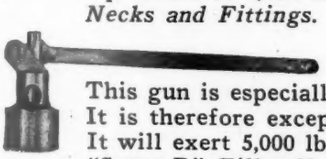
The New "SPEE-D" Universal Grease Gun Type U-1

This new gun, which is designed for terminal use will exert a pressure of 7,000 lb. per sq. inch. It is very simple and rapid in operation. It is ruggedly constructed and has the new "SPEE-D" Engaging Nozzle which is adjustable to take care of wear. *Used with Standard* "SPEE-D" *Filler Necks and Fittings.*



The "SPEE-D" Jr. High Pressure Terminal Gun T-1

This gun is also made for terminal use and is of the same type which has been in service on many railroads for the past several years. It will exert a pressure of 5,000 lb. per sq. inch. *Used with standard* "SPEE-D" *Filler Necks and Fittings.*



The "SPEE-D" Road Gun R-1

This gun is especially designed for the use of engineers out on the road. It is therefore exceptionally light in weight and simple in construction. It will exert 5,000 lb. pressure per sq. inch and is *used with our standard* "SPEE-D" *Filler Necks and Fittings.*

"SPEE-D" Filler Neck
(permanent rod cup fitting)

This is the standard "SPEE-D" Filler Neck and Fitting which has been giving such universally satisfactory service on a large number of railroads in the United States and foreign countries. Made in sizes and threaded to suit the requirements of any railroad. *Used with all* "SPEE-D" *Guns.*

RELIANCE MACHINE & STAMPING WORKS, Inc.

NEW ORLEANS, LA.

Agents and Representatives

H. C. MANCHESTER, 3756 Grand Central Terminal, New York City
Consolidated Equipment Company, Montreal
Mumford Medland, Ltd., Winnipeg
International Railway Supply Company, 30 Church St., New York City

Western (now a part of the Baltimore & Ohio) on April 1, 1891, as a machinist apprentice. He completed his apprenticeship in 1894, and served as a machinist with the B. & O. at Allegheny, Pa., for two years, beginning work with the Pennsylvania at Pittsburgh, Pa., on July 8, 1897, as a machinist. From 1901 to 1905, Mr. Hankins served as acting enginehouse foreman, machinist and leading machinist at Pittsburgh, and from April, 1905 to January 1, 1919, served successively as enginehouse foreman, machine shop fore-

Frederick W. Hankins

man, general foreman and master mechanic of the Cumberland Valley (now a part of the Pennsylvania) at Chambersburg, Pa. During the period of Federal control, he was transferred as master mechanic to the office of the general superintendent of motive power of the Pennsylvania, with headquarters at Philadelphia, Pa., and on May 1, 1923, became general superintendent of motive power of the Central region at Pittsburgh. Mr. Hankins became chief of motive power of the entire system on March 1, 1927.

E. W. SMITH has been appointed co-receiver of the Seaboard Air Line. Mr. Smith was born in Clarksburg, W. Va., on September 21, 1885. He is a graduate of the Virginia Polytechnic Institute, class of 1905. He entered railway service in June of that year and served in

E. W. Smith

various positions in the motive power department of the Pennsylvania. He was appointed assistant master mechanic at Wilmington, Del., in October, 1913; was transferred in the same capacity to Altoona, Pa., in April, 1915, and the following year became assistant engineer of motive power. He was transferred to Harrisburg, Pa., on October 10, 1917, as master mechanic, and on May 26, 1918, was transferred to Williamsport as superintendent of motive power. He returned to Altoona as superintendent of motive power in December, 1919, and the following year was promoted to engineer of transportation on the staff of the vice-president in charge of operation at Philadelphia. He was appointed general superintendent of motive power at St. Louis, Mo., on October 15, 1922; two years later was promoted to general superintendent of the Western Pennsylvania division and in September, 1926, was appointed general manager of the Eastern region. Mr. Smith, in September, 1928, was advanced to regional vice-president of the Pennsylvania, from which position he resigned.

J. W. SURLES, who has been promoted to superintendent of motive power of the St. Louis-San Francisco, with headquarters at Springfield, Mo., has been connected with the mechanical departments of the Illinois Central, the Southern Pacific, the

J. W. Surles

Frisco and the Grant Locomotive & Car Works at Houston, Tex., for 39 years. The positions he has held have included those of superintendent of shops of the Southern Pacific at Houston and of the Frisco at Springfield, being appointed to the latter post in 1923. A complete sketch of Mr. Surles' railway career appeared in the June, 1930, issue of the *Railway Mechanical Engineer*, at the time of his promotion to assistant superintendent of motive power of the Frisco.

WILLIAM R. WOOD, who has been promoted to assistant general superintendent of motive power of the Great Northern, with headquarters at St. Paul, Minn., has been connected with that railroad for 29 years. He was born at St. Paul on July 26, 1877, and in 1901 was a graduate of the University of Minnesota. In the latter year he entered railway service as a mechanical draftsman in the employ of the Great Northern, later being advanced to an inspectorship. Mr. Wood was promoted to superintendent of shops at Barnesville, Minn., in 1905, being appointed superintendent of car shops at St. Paul in 1906. In 1910 he was advanced to engineer of tests, with headquarters at St. Paul, and five years later became mechanical valuation engineer, with headquarters at the same point. Early in 1917 he was promoted to mechanical engineer,

William R. Wood

with headquarters at St. Paul, a position he held until his promotion to assistant general superintendent of motive power.

Master Mechanics and Road Foremen

R. P. LOUGHRY, traveling engineer of the Pennsylvania, Pittsburgh division, has been appointed assistant road foreman of engines of the Buffalo division.

F. C. CHARNOCK, special duty fireman of the Pennsylvania, Buffalo division, has been appointed assistant road foreman of engines of the Wheeling division.

F. R. HUSTED, assistant road foreman of engines of the Pennsylvania, Buffalo division, has been appointed assistant road foreman of engines of the Pittsburgh division.

C. E. PLOTT, has been appointed assistant master mechanic of the Galesburg and East Ottumwa division of the Chicago, Burlington & Quincy, with headquarters at Galesburg, Ill.

D. A. SMITH, acting assistant road foreman of engines of the Pennsylvania, Wheeling division, has been appointed assistant road foreman of engines of the Conemaugh division.

G. E. JOHNSON, master mechanic of the Wymore division of the Chicago, Burlington & Quincy, has been transferred to the Omaha division, with headquarters at Omaha, Neb.

J. S. FORD, master mechanic of the Omaha division of the Chicago, Burlington & Quincy at Omaha, Neb., has been transferred to the Centerville division, with headquarters at Centerville, Iowa.

THE JURISDICTION of J. Dietrich, master mechanic of the Lincoln division at Lincoln, Neb., has been extended to include the Wymore division. The position of master mechanic at Wymore, Neb., has been abolished.

(*Continued on next left-hand page*)

Nicholson Thermic
SYPHONS

of simple, durable construction, perform primary functions in the efficient operation of locomotives. They have been subjected to numerous, severe tests and the final test made recently by the University of Illinois in the laboratory of its Railway Engineering Department was the most exacting locomotive boiler test ever conducted. The Railway Engineering Department states in its bulletin:

"At all rates of evaporation the Syphon-Equipped locomotive showed a definite and notable superiority over non-Syphon engine as regards both evaporation per pound of coal and boiler efficiency."

Positive protection afforded by Syphons in the prevention of boiler explosions also, has been thoroughly proven and accepted by the Boiler Inspection Department of the Interstate Commerce Commission and by leading railway officials. Bulletin No. 220 University of Illinois will be sent upon request.

LOCOMOTIVE FIREBOX COMPANY
NEW YORK CHICAGO MONTREAL

Increased Circulation

Reduced Boiler Maintenance

Increased Economy

Unfailing Safety

Car Department

T. G. VINCENT has been appointed car foreman of the Canadian National with headquarters at Sarnia, Ont.

W. HARE has been appointed car foreman of the Canadian National, with headquarters at Palmerston, Ont., succeeding J. H. Hosking, retired.

Shops and Enginehouse

PHILIP KOCH, foreman at the Camden, N. J., enginehouse of the Reading, has retired after thirty-three years' railroad service.

J. N. A. PELLETIER has been appointed acting assistant foreman of the erecting shop of the Canadian National at Riviere du Loup, Que.

ERNEST E. SMITH, a machinist in the employ of the Southern at Spencer, N. C., has been promoted to the position of assistant night enginehouse foreman.

J. M. A. BOURDEAU has been appointed acting night locomotive foreman of the Canadian National, with headquarters at Mont Joli, Que., succeeding J. B. Levesque, retired.

H. A. BOURDEAU, locomotive foreman of the Canadian National, has been appointed general foreman in charge both of the enginehouse and locomotive shops at Riviere du Loup, Que.

Purchasing and Stores

F. G. DRIELING has been appointed division storekeeper of the Northern Pacific, with headquarters at St. Paul, Minn.

J. E. CANDELAS, assistant general purchasing agent of the National of Mexico, has been appointed superintendent of stores, with headquarters as before at Mexico, D. F.

Obituary

CHARLES ROGERS CRAIG, formerly general purchasing agent of the Southern, died at his home at Washington, D. C., on January 5, at the age of 58 years.

PETER HOWATT, division storekeeper of the Atchison, Topeka & Santa Fe at Corwith, Ill., for the past 25 years, died recently from injuries received in an automobile accident.

WALTER BYRD, who was master mechanic of the Esquimalt & Manaimo, with headquarters at Wellington, B. C., from 1918 until his retirement in 1928, died at Victoria, B. C., on December 1 at the age of 70 years.

JAMES W. GIBBONS, general foreman of the passenger car department in the shops of the Atchison, Topeka & Santa Fe at Topeka, Kan., died recently at the Santa Fe hospital in that city at the age of 65 years. Mr. Gibbons was for many years active in the affairs of the Master Car and Locomotive Painters Association of the United States and Canada and was a past chairman of that organization, which is now the Equipment Painting Section of the American Railway Association.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

ANGLE-STEEL AND SHEET-METAL EQUIPMENT.—Catalog M-S 1931, descriptive of angle-steel and sheet-metal equipment for factory, shop and office use, is being distributed by the Angle Steel Stool Company, Plainwell, Mich. The catalog is 8½ in. by 11 in. in size and contains 32 pages.

WELDING ACCESSORIES.—A complete line of electric arc welding accessories and supplies is illustrated and described and prices given in the 12-page catalog issued by the Fusion Welding Corporation, One Hundred Third street and Torrence avenue, Chicago.

BUFFALO BILLET SHEARS AND BAR CUTTERS.—Four types of shears for cutting bars and other shapes are shown in Bulletin No. 330, issued by the Buffalo Forge Company, Buffalo, N. Y. The machines cut a wide variety of bars and shapes and the electrically welded frames are built of Armor-Plate steel.

PLANER MOTORS.—Type T heavy-duty Reliance planer motors for reversing service are described in Bulletin No. 207 issued by the Reliance Electric & Engineering Company, Cleveland, Ohio. The direct-connected reversing motor eliminates belts and the desired cutting speed can be maintained regardless of changing conditions.

LINK-BELT P. I. V. GEAR.—A 16-page book, No. 1274, issued by the Link-Belt Company, 910 South Michigan avenue, Chicago, describes the new P. I. V. Gear, an all-metal variable speed transmission. Two double-page spreads illustrate the features of the unit, such as the side-tooth chain operating in contact with the toothed discs.

STATIC TESTING MACHINE.—The Waugh Equipment Company, New York, has issued a 12-page pamphlet describing the million-pound static testing machine which is a part of the Waugh-Gould testing laboratories. The machine, which is hydraulically operated and is capable of exerting a pressure of one million pounds, has an overall height of 37 ft. It is adapted for all forms of tension, compression and transverse testing. The pamphlet contains a description of the machine, its operation and the accurate instruments provided for indicating the load and travel in draft gear tests.

LUDLUM STEEL.—A catalogue attractively and conveniently bound in sectional form has been issued by the Ludlum Steel Company, Watervliet, N. Y. The binder, in which three sections are now assembled, is provided with additional wire fastenings for embodying other Ludlum catalogue or printed material issued from time to time. Two of the sections now included in the binder discuss high-speed carbon and alloy tool steels, corrosion, heat and wear-resisting steels, valve steel and Strauss metal, and high speed, special alloy, carbon and special-purpose tool steels. The third section is a reference book of steel-treating tabulations.

LANDIS MACHINES.—The Landis Machine Company, Waynesboro, Pa., has issued a number of new bulletins as follows: C-61, Landis 6-in. and 8-in. pipe threading and cutting machines; C-63, Landis stationary pipe, casing, drill pipe, line pipe and tubing die heads; D-65, Landis ¼-in. and 2-in. pipe and nipple threading machine, E-70, Landis ¾-in. and 1-in. automatic forming and threading machines; F-71, Landmatic heads for turret lathes and screw machines; F-72, Landex heads for automatic screw machines; G-73, Victor collapsible and solid adjustable taps; G-74, Victor receding chaser and collapsible taps, and H-76, Lanco heads for automatic, semi-automatic and hand-operated machines.

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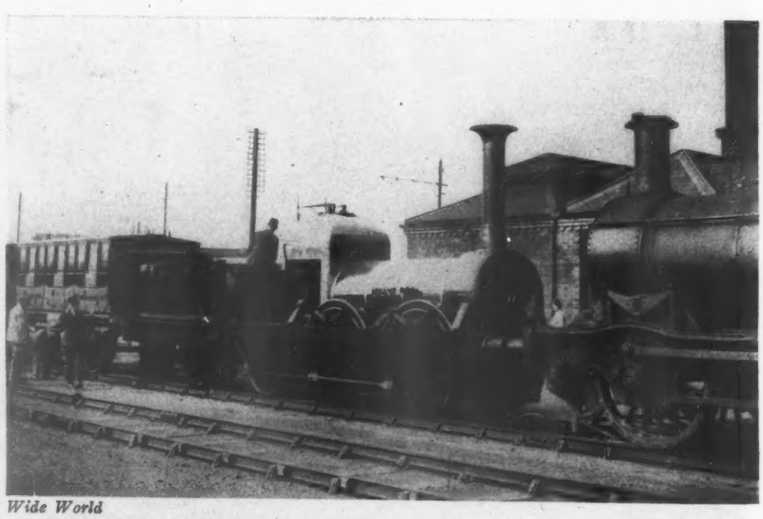

Wide World

Replicas of one of the early coaches and of the "Lion," one of the first locomotives used in regular service on the Liverpool & Manchester, as prepared for exhibition at the British Railway Centenary